Editorial Commentary

Predicting mortality after postcardiotomy venoarterial extracorporeal membrane oxygenation

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Cardiogenic shock occurring after adult cardiac surgery is often refractory to inotropic therapy and intra-aortic balloon pump mechanical support. In this scenario, venoarterial extracorporeal membrane oxygenation (VA-ECMO) provides both circulatory and respiratory support, allowing cardiopulmonary recovery (1). In extreme circumstances, VA-ECMO support may represent a bridge to implantation of ventricular assist device or to heart transplantation (2). Organizational complexity, excessive costs, even if within the range of cost-effectiveness (3,4), and high early mortality (5) are major limitations of postcardiotomy VA-ECMO. Therefore, this salvage therapy should be considered as the last-ditch effort to save the failing heart only in patients with reasonably good chances to survive. Still, valid methods of risk stratification in patients undergoing postcardiotomy VA-ECMO are not yet available and are much needed in view of the increasing use of this therapy (6). This is of particular relevance in the elderly because of their limited expectancy of life (7) as well as of clinical and ethical issues related to the treatment critically ill old patients (8). In general, the excessive morbidity and mortality associated with salvage therapies for life-threatening diseases are relevant aspects in influencing the decision-making process before commencing postcardiotomy VA-ECMO. However, refractory cardiopulmonary failure after cardiac surgery often does not allow surgeons and anaesthetists to discuss thoroughly the ethical issues and contextual features before mechanical circulatory support. In this setting, risk factor stratification for VA-ECMO support might be useful to identify patients with excessive mortality risks and to allocate resources toward those patients with chances of recovery from postoperative acute heart failure. The current ECMO risk scoring methods are derived from heterogeneous patient populations, often excluding patients affected by postcardiotomy cardiogenic shock, and these patients are those with a significant poorer outcome compared with other subsets of patients (9). A recent study demonstrated that current risk scores poorly performed in predicting 30-day mortality in patients affected by cardiogenic shock after cardiovascular surgery and managed with VA-ECMO (10). Even the SAVE score (11) that has been proven to be statistically significant, it remains suboptimal in the ability to predict early mortality. Plausible explanations are related to the intrinsic nature of the studies regarding VA-ECMO support for postcardiotomy syndrome, including small sample size often considering the prognostic impact of peri-ECMO risk factors only. Few are the series including more than 100 patients aiming to identify pre-VA-ECMO risk factors predicting early mortality (12-15). These studies revealed that advanced age and increased arterial lactate before ECMO commencement are the most common risk factors associated with increased risk of early mortality.

In this scenario of limited knowledge of factors clearly

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contraindicating the use of ECMO after adult cardiac surgery, Wang *et al.* (16) developed the REMEMBER risk score to stratify the risk of hospital mortality in patients undergoing VA-ECMO after coronary artery bypass grafting including only pre-ECMO covariates. The authors identified age, left main disease, inotropic score, as well as creatine kinase MB, serum creatinine and thrombocytopenia as independent predictors of hospital mortality. The derived additive REMEMBER score had a quite large area under the receiver operating characteristics curve (0.85, 95% CI: 0.73–0.93), making this risk score quite simple and accurate in identifying patients at prohibitive risk of early death in whom postcardiotomy VA-ECMO is not indicated (16). However, this study is potentially biased by a number of methodological pitfalls which are mostly related to the small size of the series and the long recruitment period (17). Other pitfalls may affect the validity of this study as well. First, the authors included in this analysis only patients who underwent isolated coronary surgery and this may severely limit the generalizability of this risk score in the general cardiac surgery population. Second, patients in this series had a significantly lower operative risk than previous series of VA-ECMO following CABG procedures (median EuroSCORE II, 6.0% *vs.* 12.8%) (13), which suggests that the indication for VA-ECMO in their series might not have been such a strict. In fact, Wang *et al.* (16) were able to identify patients with very low hospital mortality (13%), a finding which reflects the rather low mortality of the overall series (55%). These findings may not be replicated in studies including patients with very high operative risk. Third, the authors identified the peak level of creatine kinase-MB within 6 hours prior to VA-ECMO as an independent predictor of hospital death. This finding is difficult to be replicated because most centres monitor troponin I or T instead of creatine kinase MB and the quite long window herein adopted (6 hours) may lead to inaccurate analysis. Furthermore, it is likely that the MB parameter does not reliably stratify the severity of myocardial injury at the time of weaning from cardiopulmonary bypass because the process of myocardial damage is still present. Fourth, platelet count $<100\times10^9$/L was found to be a powerful predictor of early mortality (OR 3.56, 95% CI: 1.50–8.50), but it is unclear whether this finding is related to a problem of model overfitting or to its effects on postoperative bleeding. Finally, most of studies identified pre-ECMO serum lactate as a major determinant of poor outcome in these patients. It is unclear whether the inclusion of serum lactate and inotropic score in to the regression model might have penalized the former because of multicollinearity.

Despite these limitations, Wang *et al.* (16) showed that it is possible to develop a simple and clinically useful risk score for prediction of hospital mortality in patients with postcardiotomy refractory cardiogenic shock requiring VA-ECMO. A larger, multi-institutional study including patients undergoing a wide spectrum of adult cardiac surgery procedures is needed in order to develop an accurate risk stratification method to guide anesthesiologists, cardiac surgeons and patient's relatives in the difficult decision-making process of whether using VA-ECMO therapy after adult cardiac surgery should be commenced or discouraged.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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