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EDITORIAL

The value of clinical scores in predicting mortality of adult patients on veno-arterial extracorporeal membrane oxygenation

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Abstract

Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) is increasingly used for refractory cardiogenic shock and is still associated with frequent morbidities and high mortality. Many risk scores have been used to stratify the patients for rapid decision making. The recent studies using the risk scores during VA-ECMO support were reviewed and the conflicting results were addressed. The Survival After VA-ECMO (SAVE), modified SAVE, Sequential Organ Failure Assessment (SOFA), Simplified Acute Physiology score II (SAPS II), REMEMBER, ENCOURAGE scores were used in retrospective studies without validation prospective studies. The risk scores used in evaluation of adult patients with VA-ECMO support for refractory cardiogenic shock help in clinical judgment but should not affect decision making for withdrawal of support.

Keywords

Extracorporeal membrane oxygenation; Veno-arterial ECMO; SAVE score; modified SAVE score; SOFA score; REMEMBER score; ENCOURAGE score; SAPS II

1. Background

Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) is increasingly used as a temporary cardiac and respiratory support for patients presenting with refractory cardiogenic shock (CS) [1, 2]. The use of VA-ECMO support may represent a bridge to cardiac recovery, implantation of durable mechanical circulatory support or heart transplantation [3]. The use of VA-ECMO is still associated with high mortality and many complications including bleeding, neurological strokes, limb vascular injuries and infections [4–11]. Also, the complexity of management and costs especially with limited resources, elderly and ethical issues represent particularly important concerns [12, 13]. Therefore, it is important to stratify the patients before VA-ECMO support and to limit this high-risk facility to patients with good chances of survival.

2. The risk scores used with VA-ECMO

The Survival After VA-ECMO (SAVE) score is the first score done for predicting hospital mortality after cardiogenic shock with VA-ECMO support [4]. The SAVE score was derived from the Extracorporeal Life Support Organization (ELSO) international registry and consisted of 12 variables and 5 risk classes. A SAVE-score of zero represents 50% survival and the positive scores represent higher chances of survival to hospital discharge. Chen *et al*. [14] conducted a retrospective analysis of 154 adult patients with VA-ECMO support and documented the significant SAVE scores difference between the survivors and non-survivors. Chen *et al*. [14] did Receiver operator characteristic (ROC) analysis for SAVE score in differentiating 90 days mortality and the area under ROC (AUROC) was 0.73. Chen *et al*. [14] developed modified SAVE score by combining blood lactate to SAVE score and the ROC analysis showed a better performance (AUROC 0.84) for differentiating 90 days mortality.

Recently Amin *et al*. [15] did a retrospective analysis of 120 patients supported with VA-ECMO for refractory cardiogenic shock and found significantly different SAVE scores between the survivors and non-survivors but the SAVE score consistently underestimated the survival probability in their cohort study. Also, Amin *et al*. [15] did not find any clear trend in survival between the different SAVE risk classes which make the SAVE score alone insufficient in prognosticating adult patients with cardiogenic shock on VA-ECMO support. The prEdictioN of CS outcome for AMI patients salvaged by VA-ECMO (ENCOURAGE) risk score is another model constructed with seven pre-ECMO variables: age, body mass index, female sex, Glasgow coma score, lactate, serum creatinine and prothrombin [16]. It performed well (AUROC 0.84 (95% Confidence Interval (CI): 0.77–0.91)) but was validated only in patients supported with VA-ECMO for refractory cardiogenic shock secondary to acute myocardial infarction [16].

The predicting mortality in patients undergoing veno-arterial extracorporeal membrane oxygenation after coronary artery bypass grafting (REMEMBER) risk score is another model constructed from six pre-ECMO variables: older age, serum creatinine >150 umol/L, left main coronary artery disease, inotropic score >75, platelet count <100 × 10^9 /L, CK-MB >130 IU/L [17]. The REMEMBER score was constructed from retrospective analysis of 166 patients supported with VA-ECMO after coronary artery bypass grafting (CABG) and was validated (AUROC 0.85 (0.79–0.91)) only after CABG [17].

The Sequential Organ Failure Assessment (SOFA) score is a simple model used for assessment of organs dysfunction in various categories of critically ill patients [18]. There were conflicting results about using SOFA score in assessment of VA-ECMO patients. It showed a lesser performance when compared to SAVE and modified SAVE scores, but it was calculated only once without follow up assessment [4, 14]. Recently, SOFA score was used for assessment of adult patients during first 5 days of VA-ECMO support in a retrospective analysis of 106 patients and an increasing trend was linked to hospital mortality [7]. Another recent retrospective analysis of 103 patients showed a deficient performance of SOFA score and adding right ventricle function to SOFA score to get SOFA-RV score had a better predictivity of hospital mortality than SOFA score alone [19].

The Simplified Acute Physiology Score II (SAPS II) is a simple score including clinical and laboratory variables. It was used to assess VA-ECMO treated patients with variable reports [20, 21]. Lee *et al.* [20] conducted a retrospective analysis of 135 patients with VA-ECMO and used pre-ECMO variables to calculate SAPS II and SOFA score. Lee *et al.* [20] reported the worse SAPS II and admission SOFA scores in the non-survivors' groups with a better performance of SAPS II compared to SOFA. Fisser *et al.* [21] used different scores including SOFA, SAPS II, SAVE and modified SAVE scores in retrospective analysis of 300 VA-ECMO treated patients and reported different performances of the scores with best AUROC for SAPS II.

From all these studies, we can find different performances of the risk scores which may result from the heterogeneity of the etiology of cardiogenic shock in the different studies. Also, the different management protocols of ECMO support regarding mechanical ventilation, anticoagulation, cannulation and weaning interfere with patients' course and survival among different ECMO centers. Moreover, Barbaro *et al.* [22] retrospectively analyzed data from 290 ECMO centers and reported a volume-outcome relationship in ECMO centers with lower annual mortality rates in high volume ECMO centers. Adult patients treated with ECMO at high-volume (>30 cases per year) centers had a significantly reduced mortality (adjusted Odds Ratio (OR) 0.61; 95% CI 0.46–0.80) compared to those treated at low-volume (<6 cases per year) centers [22]. Finally, all these scores were calculated in retrospective studies including patients with distinctive characteristics and variable clinical indications for VA-ECMO support without large prospective validation studies. So, these scores should not replace the clinical judgment or affect decision making regarding further management or withdrawal of support. Moreover, the current ELSO guidelines for cardiogenic shock management do not include use of any score [23].

3. Conclusion

The risk scores used in evaluation of adult patients with VA-ECMO support for refractory cardiogenic shock help in clinical judgment but should not affect decision making for withdrawal of support.

ABBREVIATIONS

AUROC, Area Under Receiver operator characteristic; CS, Cardiogenic shock; CI, Confidence Interval; ELSO, Extracorporeal Life Support Organization; ENCOURAGE score, prEdictioN of CS outcome for AMI patients salvaged by VA-ECMO score; OR, Odds Ratio; ROC, Receiver operator characteristic; SAVE score, Survival After VA ECMO score; SAPS II, Simplified Acute Physiology score II; SOFA score, Sequential Organ Failure Assessment score; VA-ECMO, Veno-Arterial Extracorporeal Membrane Oxygenation.

AUTHOR CONTRIBUTIONS

ML and RQ wrote and approved this article.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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