

# Optimizing SAVE Score for Intraoperative Complications

Michael L. Cheng<sup>1</sup>, Marjorie Howard<sup>2</sup>, Suprateek Kundu<sup>2</sup> and Divya Gupta<sup>3</sup>

Emory School of Medicine<sup>1</sup>, Rollins School of Public Health – Data Analytics and Biostatistics Core<sup>2</sup>, Emory University Department of Medicine - Division of Cardiology<sup>3</sup>

## Study Objectives:

- Validate SAVE Score as a tool for predicting in-hospital survival for cardiogenic shock patients requiring VA-ECMO therapy.
- Identify additional factors that can predict prognosis in this patient population.

**Conflicts of Interest:** None

## Introduction:

- Veno-arterial extracorporeal membrane oxygenation (VA ECMO) is an effective support therapy for refractory cardiogenic shock and can be used as a bridge to more definitive therapy<sup>1</sup>
- VA ECMO has high rates of complications and requires considerable financial and human resources<sup>2</sup>. Selecting patients most likely to benefit from ECMO is controversial
- The Survival After Veno-arterial ECMO (SAVE) Score is a scoring system developed by Schmidt et al. as a tool to predict survival for patients receiving ECMO therapy for cardiogenic shock<sup>3</sup>.
- SAVE score is calculated using 13 parameters: age, weight, etiology of cardiogenic shock, acute/chronic renal failure, HCO<sub>3</sub>, duration of intubation prior to ECMO initiation, peak inspiratory pressure, pre-ECMO cardiac arrest, diastolic BP, pulse pressure, liver failure, and CNS dysfunction.

## Validating SAVE Score:

We retrospectively reviewed all cardiogenic shock patients who received VA-ECMO therapy at our institution between 2016 – 2019, collecting patient variables, ECMO data, calculated SAVE scores and patient outcomes. We identified 66 cardiogenic shock patients treated with VA-ECMO and stratified them by SAVE score risk categories and measured survival to discharge.

### Survival to discharge status by SAVE score category

Risk Category	V	IV	III	II	I	
SAVE Score	-10 and below	-9 to -5	-4 to 0	1 to 5	> 5	ALL
Predicted Survival	18% (2.34/13)	30% (7.5/25)	42% (8.4/20)	58% (4.06/7)	75% (0.75/1)	
Emory (Overall)	30.8% (4/13)	28% (7/25)	40.0% (8/20)	57.1% (4/7)	0% (0/1)	34.85% (23/66)

The **p-value from a chi-square test** (4 degrees of freedom, and significance level = 0.05) was **0.739**. This means that there is no significant difference in the predicted survival and our observed survival.

## Intraoperative Complication Patients

Patients with intraoperative complication causing hemodynamic compromise as the etiology of their cardiogenic shock were identified and their survival to discharge rates calculated.

### Survival in Intraoperative Complication Patients vs. Overall

Risk Category	V	IV	III	II	I	
SAVE Score	-10 and below	-9 to -5	-4 to 0	1 to 5	>5	All
Emory (Overall)	30.8% (4/13)	28% (7/25)	42% (8/20)	58% (4/7)	0% (0/1)	34.85% (23/66)
Emory (Intraop)	0% (0/3)	0% (0/4)	33.33% (3/9)	50% (1/2)	-	22.22% (4/18)

Observed survival rates for intraoperative complication patients at our institution were lower than predicted and overall observed in every risk category, suggesting this patient population may be sicker than reflected in their original SAVE score.

## Modified SAVE Score:

-2 SAVE Score modifier applied to patients with an intraoperative complication as the etiology of their cardiogenic shock

### Survival to Discharge Status by **Modified** SAVE Score

Risk Category	V	IV	III	II	I	
SAVE Score	-10 and below	-9 to -5	-4 to 0	1 to 5	> 5	All
Predicted Survival	18% (2.7/15)	30% (7.5/25)	42% (7.56/18)	58% (4.06/7)	75% (0.75/1)	
Emory (Overall)	30.8% (4/13)	28% (7/25)	42% (8/20)	58% (4/7)	0% (0/1)	34.85% (23/66)
Emory (Overall) (Modified)	<b>26.7% (4/15)</b>	28% (7/25)	<b>44.4% (8/18)</b>	57.1% (4/7)	0% (0/1)	34.85% (23/66)

The **p-value from a chi-square test** (4 degrees of freedom, and significance level = 0.05) was **0.739**. This means that there is no significant difference in the predicted survival and our observed survival.

## Conclusions:

The survival rates predicted by SAVE score were not statistically different from the observed rates of the patient population at our institution. SAVE score may be a valid tool for predicting in-hospital survival for cardiogenic shock patients requiring VA-ECMO therapy.

Applying a negative score modifier to intraoperative complication patients brought measured survival rates closer to predicted, suggesting this etiology of cardiogenic shock may portends worse survival than reflected in original SAVE score. Further study to identify patterns of complications and survival may aid in more accurate risk stratification.

## References:

- [1]: Connolly SJ. Evidence-Based Analysis of Amiodarone Efficacy and Safety. Circulation. 1999; 100:2025-2034.
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