of the data set, certain information not included in the NHAMCS data (e.g., chronic medications, etc),and differences in critical care admission criteria, hospitalization, and transfers between facilities. The authors note that although they believe their predictive model is superior to the conventional ESI model, the performance is not without flaws, which they attribute to limited predictors, clinical factors, physician practice patterns, resources, etc.

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Comment: This study introduces the possibility of computerized modeling to predict high acuity ED patients rather than the traditional ESI model. While these models do show improved accuracy for identifying patients who will need admission or critical care, further study and validation will be needed before computerized modeling could be incorporated into ED operations.

☐ EXTRACORPOREAL MEMBRANE OXYGENATION FOR SEPTIC SHOCK.

Falk L, Hultman J, Broman LM. *Crit Care Med.* 2019;47(8):1097-1105

Septic shock has a very high mortality rate despite early aggressive resuscitation with antibiotics, fluids, and vasopressors. Extracorporeal membrane oxygenation (ECMO) has become the standard of care for refractory neonatal and pediatric septic shock, however it is not as common in adults. The current data is scarce in regards to the mortality benefit of ECMO in adult septic shock.

The goal of this retrospective observational study was to estimate the mortality benefit of ECMO in adult refractory septic shock patients. This study evaluated adult patients in a high volume ECMO center in Sweden who presented between January 2012 and December 2017. Patients were diagnosed with septic shock meeting the Sepsis-3 criteria with suspected end-organ hypoperfusion; objectively they required vasoactive medications to maintain a mean arterial pressure (MAP) of >65 mmHg with a vasoactive inotropic score (VIS) >50 despite adequate fluid resuscitation at time of ECMO initiation. Patients excluded from the study were those who had CPR during ECMO initiation as well as those who had their entire ECMO treatment done outside the ECMO center. Patients were either placed on venovenous or venoarterial ECMO. Venovenous ECMO was used for PaO2:FiO2 ratio of 60-80 mmHg when conventional respiratory therapy had failed. Venoarterial ECMO was used in cardiocirculatory failure defined as one of the following: persistent lactate >5mmol/L, mixed venous saturation (SVO) <55%, cardiac index <2L/min/m2 (>1 hour), rapidly deteriorating ventricular dysfunction, refractory arrhythmia, VIS>50 (<1 hour), VIS >45 (>8 hours), or VIS>40 if myocarditis was present. All patients received an echocardiogram prior to ECMO initiation. The primary outcomes measured were ECMO unit mortality, hospital mortality and 6-month mortality. The secondary outcomes were ECMO related complications and days on ECMO.

Thirty-seven patients were included in the study with 27 patients placed on venoarterial ECMO and 10 patients placed on venovenous ECMO. Twenty of the patients had left ventricular failure (LVF). The overall survival rates for all patients on ECMO were 81.1% at discharge from the ECMO unit, 78.4% at hospital discharge, and 59.5% at 6-month follow up. Patients with LVF had a 90% survival rate at time of leaving the ECMO unit as well as at time of hospital discharge, but 75% survival at 6-months. The survival in patients with LVF was better with venoarterial ECMO (94.4%, 94.4%, 83.3% for ECMO unit discharge, hospital discharge and 6 month respectively) compared to venovenous ECMO (50%, 50%, 50%, respectively). The survival in patients with non-LVF was 70.6% for ECMO unit discharge, 64.7% for hospital discharge, and 47.1% for 6-months. It was similar for venovenous and venoarterial ECMO in the non-LVF group (62.5% vs 66.7% for ECMO unit discharge, 62.5% vs 66.7% for hospital discharge, 37.5% vs 55.6% for 6-month). The mortality difference between patients with LVF vs non-LVF was significant at hospital discharge (p=0.044) and at 6-months (p=0.081). ECMO complications included higher risk of in hospital death (50% vs 11%, p=0.011) and all cause mortality at 6-month follow up (70.0% vs 29.6%, p=0.026) in the venovenous ECMO group compared to the venoarterial group. Thirty eight percent of the patients experienced ventilator associated pneumonia, two experienced bleeding, and two experienced limb ischemia in the cannulated limb. The patients who expired on ECMO were those who had care withdrawn secondary to futility of care after intracranial complications (bleeding, ischemia, or herniation).

The authors concluded that venoarterial ECMO could improve the mortality rate of septic shock adult patients when used by an experience physician at a high use ECMO center. They concluded this benefit may be even more dramatic in those septic shock patients with cardiac failure. Limitations of the study included the small number of patients within the study itself as well as the overall small number of adult septic patients that ECMO has been utilized on which limits the generalizability of the results. The use of a single center in this study also further limits this generalizability. Finally, physicians decided which ECMO setting to use (venovenous or venoarterial) which may introduce selection bias.

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Comment: There are currently no randomized control trials comparing ECMO in adult septic shock patients with the current standard of care. This retrospective study is the first step in establishing ECMO as an potential treatment for adult refractory septic shock, however there needs to be further studies to better elucidate the benefits versus risks of ECMO treatment in these types of patients prior to a change in current practice.