Discriminant Accuracy of the SOFA Score for Determining the Probable Mortality of Patients With COVID-19 Pneumonia Requiring Mechanical Ventilation

The COVID-19 pandemic has raised concern regarding the capacity to provide care for a surge of critically ill patients that might require excluding patients with a low probability of short-term survival from receiving mechanical ventilation. A survey identified 26 unique COVID-19 triage policies, of which 20 used some form of the Sequential Organ Failure Assessment (SOFA) score.

However, studies performed in 2016 and 2017 have shown only moderate discriminant accuracy of the SOFA score for predicting survival in intensive care unit (ICU) patients with sepsis and an area under the receiver operating characteristic curve (AUROC) of 0.74 to 0.75. We hypothesized that the SOFA score might be less accurate in patients requiring mechanical ventilation for COVID-19 pneumonia because such patients generally have severe single-organ dysfunction and less variation in SOFA scores.

Methods | This retrospective study was approved and exempted from the requirement for informed consent by the University of Arizona institutional review board. Data were from patients treated at 18 ICUs in the southwestern US between March 1, 2020, and August 31, 2020. We included consecutive patients aged 18 years or older with a diagnosis of COVID-19 pneumonia and receiving oxygen therapy for 4 hours or longer before undergoing endotracheal intubation. We calculated that a sample size of 640 patients would provide 95% CI for an AUROC of ±5%, assuming an AUROC of 0.74 to 0.75. We hypothesized that the SOFA score might be less accurate in patients requiring mechanical ventilation for COVID-19 pneumonia because such patients generally have severe single-organ dysfunction and less variation in SOFA scores.

Results | Between March 1, 2020, and August 31, 2020, 2546 patients with COVID-19 were admitted to study ICUs. Of these, 972 were intubated 4 hours or longer after receiving oxygen, but 297 lacked sufficient data to calculate the SOFA score. The characteristics of the remaining 675 patients appear in the Table.

The median SOFA score was 6 (interquartile range, 4-8). Respiratory SOFA subscores were 3 to 4 in 83.5% of patients. The other SOFA subscores were 0 to 1 in 72.1% of patients for
the renal system, 78.5% for the central nervous system, 94.2% for coagulation, 95.1% for the cardiovascular system, and 96.3% for the hepatobiliary system. Four hundred patients (59.3%) died or were discharged to hospice. The AUROC for SOFA score was 0.59 (95% CI, 0.55-0.63) and for age was 0.66 (95% CI, 0.62-0.70) (P = .02) (Figure).

**Discussion** | The discriminant accuracy of the SOFA score for mortality prediction in patients prior to intubation for COVID-19 pneumonia was poor and significantly inferior to simply using age. This finding has several potential explanations. The SOFA score was designed for patients with sepsis and only 3 of the 6 equally weighted organ system subscores (respiratory, renal, and hepatobiliary) are associated with mortality in COVID-19. Compared with previous studies, this study population had higher, less variable SOFA scores with a lower proportion of patients (9/675) with cumulative scores of 0 to 2; such patients do not exhibit severe organ system dysfunction and can be relatively accurately predicted to survive. All patients in this study had respiratory failure requiring mechanical ventilation, which is the major cause of death in patients with COVID-19 pneumonia. Limitations of this study include missing data for 297 of 972 patients and restricted generalizability due to the distinctive patient population.

The SOFA score possesses inadequate discriminant accuracy to be used for ventilator triage of COVID-19 patients. A better option is needed that incorporates variables specifically related to mortality in patients with COVID-19 pneumonia requiring mechanical ventilation.

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**Accepted for Publication:** February 1, 2021.

**Published Online:** February 17, 2021. doi:10.1001/jama.2021.1545

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**Author Contributions:** Dr Raschke had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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**Supervision:** Heise.

**Conflict of Interest Disclosures:** None reported.

**Funding/Support:** Funded in part by grant 2196 from the Flinn Foundation.

**Role of the Funder/Sponsor:** The Flinn Foundation had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.


**COMMENT & RESPONSE**

**Effect of Early Recombinant Human Erythropoietin on Neurodevelopmental Outcomes at Age 5 Years**

**To the Editor** The Research Letter by Dr Natalucci and colleagues reported no benefits of early high-dose recombinant human erythropoietin (rhEpo) on neurodevelopmental outcomes at age 5 years in very preterm infants. We are concerned about the interpretation of this study because the enrolled neonates carried a very low risk of brain damage, given their average birth weight of 1200 g and average gestational age of more than 29 weeks. In 2016, the same authors and, recently, others reported no advantage of rhEpo in preterm infants when examining neurodevelopmental outcome at age 2 years. We previously voiced criticism about the unfounded selection of the 2-year time point, and we are concerned these publications will hamper beneficial use of rhEpo treatment in preterm infants.