Fast Prediction of Pediatric Sepsis Mortality

Source: *Schlapbach LJ, MacLaren G, Festa M, et al. Prediction of pediatric sepsis mortality within 1 h of intensive care admission. Intensive Care Med. 2017 Feb 20 [published online ahead of print]; doi:10.1007/s00134-017-4701-8*

Researchers from multiple institutions conducted a retrospective cohort study to identify patient characteristics and physiological parameters that could be used to predict 30-day mortality among children admitted to the intensive care unit (ICU) with septic shock. All children <16 years old who were admitted to an ICU in Australia or New Zealand between 2012 and 2015 who had sepsis or septic shock, as determined by using diagnosis codes in the Australia and New Zealand Paediatric Intensive Care Registry, were eligible. Patient factors and physiological parameters, such as respiratory, circulatory, metabolic, and neurological factors available within the first hour of ICU admission, were abstracted from the database. The primary outcome was mortality within 30 days of ICU admission. Researchers used multivariable logistic regression models to identify the group of patients and physiological factors that were the best predictors of 30-day mortality, then developed a sepsis scoring system based on these variables and assessed the performance of this sepsis score by using regression models.

There were 4,403 pediatric ICU admissions for sepsis over the study period. Mortality within 30 days of ICU admission was 5.2%, with a median time to death of 1.9 days. The patient factors that were the best predictors of mortality were immunosuppression and readmission. The physiological parameters that were the best predictors of mortality included FIO_2/PaO_2 ratio, ventilation during the first hour, systolic blood pressure <5th percentile, cardiac arrest preadmission, lactate level, and dilated, unresponsive pupils. When these patient and physiological variables were combined into a sepsis scoring system, every 1-point increase in sepsis score was associated with a 28.5% increase in the relative odds of death.

Researchers conclude that a sepsis score based on patient and physiological factors available within 1 hour of ICU admission can help predict mortality.

COMMENTARY BY

Susan L. Bratton, MD, MPH, FAAP, Pediatric Critical Care Medicine, University of Utah, Salt Lake City, UT

Dr Bratton has disclosed no financial relationship relevant to this commentary. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

Several critical care injuries and illnesses are characterized by fulminant onset and risk of rapid progression to death. Examples include severe traumatic brain injury with development of intracranial hypertension within the first 24 hours after injury[1] and severe sepsis from invasive bacterial infections.[2] Meningococcal sepsis typified by evolution of a petechial rash into purpura fulminans, with concurrent adrenal suppression and myocardial depression, often leads to a rapid death. And, while pathogen virulence and host susceptibility contribute to lethal outcomes, delayed initiation of antimicrobial and shock therapy due to late recognition of septic shock are of major import.[3] In the current study, half of pediatric sepsis deaths, including three-quarters of deaths in previously healthy children, occurred within 48 hours of ICU admission.

The current investigators sought to update the clinical definition of septic shock and to improve mortality prediction to enhance patient selection for potential early-intervention studies. Such clarity is essential for several reasons. The 2 most commonly used scoring systems to estimate risk-adjusted pediatric ICU mortality are the Pediatric Risk of Mortality (PRISM) index and the pediatric index of mortality (PIM), both of which have been recalibrated over time.[4] PRISM is used primarily in the United States, is almost entirely based on physiological data, and uses the worst values within the first 24 hours of ICU admission, so this score is not helpful in the determination of children at high risk for rapid death. The current authors demonstrated that a few variables obtained within 60 minutes of ICU admission can be used to identify children with substantially higher risk of mortality.

Because overall mortality among pediatric patients with septic shock is relatively low, a large study will likely be required, even if the intervention is expected to result in a substantial mortality difference. The placebo-controlled trial of bactericidal/permeability-increasing protein (BPI) is an instructive example.[2] BPI is naturally stored in neutrophil granules and binds to and neutralizes endotoxin.

BPI was administered to 190 patients as a bolus, followed by a 24-hour infusion for meningococcal infections; 203 patients received placebo. Fifty-seven patients were excluded because they died or met criteria for imminent death before receiving the 24-hour infusion. The primary outcome was mortality, which did not differ significantly (14 [7%] in the rBPI21 group vs 20 [10%] in the placebo group). The pharmaceutical sponsor lost interest in the medication.

Bottom Line: The revised sepsis mortality prediction model, created by using readily available cardiorespiratory and metabolic parameters—including lactate—demonstrates good discrimination. The derived sepsis score can serve to more accurately evaluate those at risk for death who might benefit from new sepsis therapies.

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