mNUTRIC Score in ICU Mortality Prediction: An Emerging Frontier or Yet Another Transient Trend?

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The intensive care unit (ICU) patients are at an increased risk of malnutrition. In critically ill patients, malnutrition is present in between 38 and 78%.[1] Malnutrition results in impaired wound healing, altered drug pharmacokinetics, higher rates of nosocomial infections, increased pressure ulcer and wound dehiscence, increased length of hospital day, and all-cause mortality.[2,3] In this context, there is an interplay between inflammation and malnutrition that exacerbates a catabolic condition by causing anorexia, decreased food intake, muscular catabolism, and insulin resistance. Inflammation, undernutrition-driven catabolism, and inadequate dietary intake are identified as key drivers for disease-related malnutrition.[4,5] The response to nutrition is also modulated by inflammation.

Upon admission to the ICU, approximately two-thirds of the patients, nutritional status deteriorates in the absence of sufficient nutritional support.[1] Thus, nutritional support forms one of the cornerstones in the management of critically ill patients. Numerous techniques for nutritional assessment have been investigated, however the majority of them lack an inflammatory biomarker component in their assessment. Since the pathophysiology of malnutrition in critically ill individuals is directly linked to inflammation, new screening tools have been the focus of interest which includes the inflammatory process as a risk factor. The nutrition risk in critically ill (NUTRIC) score was the first nutritional risk assessment tool published and validated specifically for ICU patients introduced by Heyland et al.[2] This score identifies the individual who will benefit from the aggressive nutritional support according to the risk of malnutrition. Nutrition risk in critically ill - score includes age, days from admission to ICU, disease severity based on acute physiology and chronic health evaluation II (APACHE-II), number of comorbidities and sequential organ failure assessment (SOFA) scores on ICU admission and interleukin-6 (IL-6) is an optional variable. The authors recommend utilizing the score in situations when IL-6 values are unavailable, as the inclusion of IL-6 did not enhance the score's discriminative capacity and may be removed from the NUTRIC score. The modified NUTRIC score (mNUTRIC) is the name given to this corrected score. which is validated across multiple observational studies, across various nations and distinguishes between ICU patients who will gain more (or less) from an early-adapted protein-energy provision in critically ill patients.[6] Numerous studies suggested that in patients with high mNUTRIC scores, prompt and appropriate nutritional therapy could lower mortality, as there is an association between nutritional intake, mortality, and mNUTRIC score.[5–8] This is supported by a

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meta-analysis conducted on modified NUTRIC scores by Ibrahim et al.[7] They concluded that the promising screening method is the mNUTRIC score to assess malnutrition and also discovered a link between critically ill patients' 28-day mortality and a high mNUTRIC score.

The article titled "Modified NUTRIC score as a predictor of all-cause mortality in critically ill patients: A systematic review and meta-analysis" in the current issue of the journal is another novel effort in the same realm.[9] The study attempts to elevate the mNUTRIC score beyond its traditional role as a nutritional risk assessment tool to a mortality predictor in patients with severe illness, evaluating the association between 28-day mortality and mNUTRIC score in the previous meta-analysis. The study's rationale is grounded in scientific validity, given that the mNUTRIC score incorporates established mortality prediction scoring systems such as APACHE and SOFA.

Predicting mortality in the ICU is considered a significant objective for critical care physicians globally. Over time, numerous models ranging from simple screening tools to intricate scoring systems such as APACHE, SOFA, SAPS, and MPM scores have been rigorously tested.[10,11] More recently, there has been a surge in the development and validation of artificial intelligence (AI)-based prediction models in this domain.[12]

The meta-analysis includes a large sample size involving a retrospective or prospective cohort of 31 studies involving 13,271 patients. Some noteworthy features of the study include PROSPERO (The International Prospective Register of Systematic Reviews) registration, well-defined search terms and inclusion of multiple major databases in search strategy, following preferred reporting items for the systemic review and meta-analysis (PRISMA)

guidelines, the use of quality in prognosis studies (QUIPS) tool for risk of bias assessment and the planned subgroup analysis based on the cut-off values of mNUTRIC score of 5. The results showed that the mNUTRIC score has strong discrimination capabilities as shown in the area under the curve (sAUC) of 0.80 (95% CI: 0.74–0.84) in predicting the mortality in critically ill patients with a pooled sensitivity of 0.79 (95% CI: 0.74–0.84) and pooled specificity of 0.68 (95% CI: 0.63–0.74). The funnel plot revealed no discernible publication bias, which strengthens the validity of the study's conclusions. However, the study could have benefitted from the inclusion of a summary of the findings table to help minimize any form of reviewer bias. Also, the lack of randomized control trials has affected the quality of evidence. The data is insufficient among eight trials out of thirty-one resulting in diminished study power. The cause for heterogeneity appears to be clinical and methodological heterogeneity in the cohorts of the included study rather than statistical heterogeneity. Not every patient will respond to nutrition therapy in the same way due to the existence of heterogeneity in critically ill patients.[13] To deal with heterogeneity in the study, authors followed a random effect model in meta-analysis, had a predefined subgroup analysis, and performed meta-regression analysis also, where the source of the variables that affect the study variations was compared, combined, and synthesized from the research findings of multiple studies while adjusting for the effects of available covariates through regression techniques.[14] This shows the robustness of the statistical methods employed by the authors. To conclude, the comprehensiveness of the systematic review and meta-analysis needs to be applauded as the present study sheds light on the good pooled predictive power of the mNUTRIC score to predict 28-day mortality in critically ill patients. Given these limitations, the authors underscore that the study needs further validation for the use of mNUTRIC score as a mortality predictor.

Despite the notable interest, there remains a considerable journey ahead regarding the usefulness of the mNUTRIC score in predicting mortality due to a variety of circumstances at the patient's bedside. Primarily, its calculation proves cumbersome, requiring the computation of both APACHE and SOFA scores, thus potentially limiting its feasibility to electronic ICU environments. Furthermore, the necessity for larger sample sizes persists to validate the mNUTRIC score adequately, as the majority of mortality prediction models have historically been established on cohorts exceeding one hundred thousand patients. Additionally, within the contemporary landscape of big data and AI-driven mortality prediction models, the mNUTRIC score must endure the scrutiny of time to demonstrate its relevance. Future research should focus on comparative analyses between the mNUTRIC score and APACHE, assessing potential enhancements in the discriminant capability of APACHE. Moreover, future trials could also explore the mNUTRIC score's utility in predicting various surrogate markers of ICU outcomes like heightened resource utilization, ventilator-free days, and organ-specific dysfunctions.

Departing from reliance on scoring systems or singular AI-based models, a shift towards employing multiple models (called ensemble modeling)—such as neural networks, amalgamations of decision trees, and support vector machines—is imperative. This approach utilizes the diverse strengths of various models while addressing their respective limitations. Additionally, an ensemble model facilitates real-time predictions, accommodating the dynamic fluctuations in patient status within clinical settings. Predicting mortality in the ICU presents inherent challenges, necessitating the exploration of ensemble modeling approaches amidst technological advancements.

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