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ORIGINAL ARTICLE

Predicting 28–Day Sepsis Mortality: A Comparison Between mNUTRIC and APACHE II

Dadang Mulyawan,[1,2] Erwin Pradian,[2] Ardi Zulfariansyah[2]
[1]Sayang Regional Hospital Cianjur, Indonesia
[2]Department of Anesthesiology and Intensive Care, Faculty of Medicine Universitas Padjadjaran/ Dr. Hasan Sadikin General Hospital, Bandung, Indonesia

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Corresponding Author:
Dadang Mulyawan
Sayang Regional Hospital
Cianjur, Indonesia
E-mail:
dadang22001@mail.unpad.ac.id

Abstract

Introduction: Sepsis with malnutrition increases complications and mortality in ICU patients. The modified Nutrition Risk in Critically Ill (mNUTRIC) score assesses nutritional risk and predicts mortality, whereas APACHE II does not account for nutritional status. This study compared mNUTRIC and APACHE II for predicting 28–day mortality in ICU patients with sepsis.

Methods: This prospective observational study was conducted from February to April 2024. Sepsis patients admitted during the study period were included. Discriminatory performance for predicting 28–day mortality was evaluated using the area under the receiver operating characteristic curve (AUROC). Comparison between scoring systems was performed using DeLong's non–parametric test.

Results: A total of 39 ICU patients were included. The mean mNUTRIC score was 4.44±2.23, and the mean APACHE II score was 17.59±5.28. The AUROC value was 0.825 for the mNUTRIC score and 0.789 for the APACHE II score. DeLong's test showed that the mNUTRIC score had significantly better discrimination for predicting 28–day mortality than the APACHE II score (p=0.011).

Discussion: mNUTRIC integrates nutritional and chronic health factors, capturing patients' physiological reserve more comprehensively than APACHE II. Early identification of high–risk patients may guide targeted interventions and ICU resource allocation.

Conclusion: The mNUTRIC score demonstrated superior discriminatory ability compared to the APACHE II score in predicting mortality among sepsis patients in the ICU. Incorporating nutritional risk assessment may improve mortality prediction and clinical decision–making in critically ill sepsis patients.

Keywords: APACHE II score; mNUTRIC score; mortality; sepsis

Introduction

Sepsis and septic shock remain major global health issues, with an incidence of approximately 300 cases per 100,000 people annually in the United States.[1] Sepsis can lead to malnutrition due to the effects of stress catabolism and inadequate nutritional intake.[2] Nutritional risk screening is the initial step to identify hospitalized patients who could potentially benefit from nutritional interventions.[3]

Mortality predictors in the intensive care unit (ICU) are essential for triage, resource allocation, determining appropriate levels of care, and communicating with patients and

families.[4] Conventional assessments such as APACHE II, SAPS, and SOFA are considered accurate in predicting mortality.[5] The Nutrition Risk in Critically Ill (NUTRIC) score was originally used for nutritional risk screening, but the Modified NUTRIC (mNUTRIC) score, which does not require IL–6 testing has also been validated.[6] Several studies have shown a correlation between mNUTRIC scores and mortality rates in septic patients.[7] However, research comparing the predictive ability of mNUTRIC and APACHE II specifically in septic patients in the ICU remains limited. Therefore, further study is needed to compare the prognostic performance of these two scores.

Subjects and Methods

This prospective observational study compared the discrimination of mNUTRIC and APACHE II scores for 28–day mortality in septic patients in the ICU (February–May 2024). Subjects were selected using consecutive sampling. Inclusion criteria were patients aged ≥18 years diagnosed with sepsis according to Sepsis–3 criteria. Exclusion criteria were patients with a history of ICU care elsewhere and patients receiving palliative care. This study was approved by the Health Research Ethics Committee of Dr. Hasan Sadikin General Hospital (No. DP.04.03/D.XIV.6.5/124/2024).

Demographic and characteristic data were obtained from medical records. For patients with sepsis upon admission, scores were assessed within 24 hours. For those developing sepsis in the ICU, scores were assessed at the time of diagnosis. Discrimination was assessed by calculating the Area Under the Receiver Operating Characteristic (ROC) curve (AUC). The cut–off point was determined using the Youden Index. Comparison of AUROC values was analyzed using DeLong's non–parametric test with a significance level of $p<0.05$.

Results

The study included 39 septic patients. The population consisted of 21 males (53.8%) and 18 females (46.2%), with a mean age of 54.5±16.4 years. The mortality rate was 43.6% (17 patients). The mean APACHE II score was 17.59±5.28, the mean SOFA score was 9.44±2.06, and the mean mNUTRIC score was 4.44±2.23 (Table 1).

The optimal cut–off for the mNUTRIC score was 5, whereas for the APACHE II score it was

Table 1 Baseline Characteristics of Study Subjects

Characteristics	Total (n=39)	Mean±SD	Median (Min–Max)
Gender			
Male	21 (53.8%)		
Female	18 (46.2%)		
Age (years)		54.5±16.4	48 (18–79)
Mortality Status			
Survived	22 (56.4%)		
Deceased	17 (43.6%)		
APACHE II Score		17.59±5.28	17 (11–30)
Survived		15.18±3.17	14 (11–24)
Deceased		23.24±3.33	23 (18–30)
SOFA Score		9.44±2.06	8 (5–15)
Survived		7.14±1.12	7 (5–9)
Deceased		11.12±2.20	11 (7–15)

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Table 1 Baseline Characteristics of Study Subjects (continued)

Characteristics	Total n=39(%)	Mean±SD	Median (Min–Max)
mNUTRIC Score		4.44±2.23	4 (1–9)
Survived		3.38±2.27	3 (1–7)
Deceased		5.20±2.12	5 (3–9)
Infection Source			
Pneumonia	17 (43.6)		
Intra-abdominal	8 (20.5)		
Urogenital	4 (10.3)		
Bloodstream	10 (25.6)		

18.5. Patients with an mNUTRIC score ≥5 had a significantly higher relative risk for 28–day mortality (RR=3.84, p<0.001) compared to those with a score <5. Similarly, patients with an APACHE II score ≥18.5 had a higher relative risk (RR=2.88, p<0.001) (Tables 2 and 3).

Analysis showed that the mNUTRIC score had "excellent" discrimination (AUROC 0.825, sensitivity 87.2%, specificity 77.8%). APACHE II had "acceptable" discrimination (AUROC 0.798, sensitivity 84.4%, specificity 75.2%). Delong's test confirmed that mNUTRIC was statistically superior to APACHE II in predicting 28–day mortality (p=0.011) (Table 4).

Discussion

The primary objective of this clinical study was to evaluate and compare the discrimination performance of the modified Nutrition Risk in Critically Ill (mNUTRIC) score and the Acute Physiology and Chronic Health Evaluation II (APACHE II) score in predicting 28–day mortality among sepsis patients in the Intensive Care Unit (ICU). Our findings demonstrate that the mNUTRIC score (AUROC 0.825) provides "excellent" discrimination, which is statistically superior to the "acceptable" performance of the APACHE II score (AUROC 0.798; p=0.011). This suggests that integrating nutritional risk parameters into severity assessment provides a more precise prognostic outlook for patients with sepsis than traditional physiological scoring alone.

In this study, the optimal cut–off for the mNUTRIC score was 5. Patients with an mNUTRIC score ≥5 had a significantly higher

Table 2 28–Day Mortality Based on mNUTRIC Score Cut–off

mNUTRIC Score	Survived (n)	Deceased (n)	Relative Risk (RR)	p–value
Score <5	19 (48.72%)	5 (12.82%)	3.84 (3.65–4.03)	< 0.001*
Score ≥5	3 (7.69%)	12 (30.77%)		

Note: *Chi–Square Test

Table 3 28–Day Mortality Based on APACHE II Score Cut–off

APACHE II Score	Survived (n)	Deceased (n)	Relative Risk (RR)	p–value
Score <18.5	17 (43.59%)	6 (15.38%)	2.88 (2.73–3.02)	< 0.001*
Score ≥18.5	5 (12.82%)	11 (28.21%)		

Note: *Chi–Square Test

Table 4 Comparison of Discrimination Values for 28–Day Mortality Prediction

Scoring System	AUROC	Sensitivity	Specificity	PPV	NPV	P–value
mNUTRIC Score	0.825	87.2%	77.8%	70.6%	86.4%	0.011*
APACHE II Score	0.798	84.4%	75.2%	64.7%	80.9%	–

Note: *Chi–Square Test

risk of 28–day mortality (RR=3.84) than those in the lower–risk group (p<0.001). This finding is strongly supported by previous literature reporting that mNUTRIC scores are significantly higher in non–survivors and act as a robust independent predictor of hospital mortality.[8] A high mNUTRIC score has been associated with an odds ratio (OR) for mortality as high as 6.97, underlining its sensitivity in the critically ill population.[9]

Comparing our results to other regional studies, research in Malaysia and Iran on septic populations also identified that patients with high mNUTRIC scores (≥5 or 6) faced significantly higher mortality rates.[10,11,17,18] A comprehensive meta–analysis involving over 4,000 patients confirmed that an mNUTRIC score ≥5 is associated with a two–fold increase in the risk of death.[12] Furthermore, in specific septic cohorts, mNUTRIC has shown a higher odds ratio for mortality (OR 2.24) compared to APACHE II (OR 1.21), which mirrors our finding that mNUTRIC is more potent in discriminating survival outcomes.[13]

For the APACHE II score, the identified cut–off was 18.5, which also showed significant prognostic value (RR=2.88). While mean APACHE II scores in our deceased group (23.24±3.33) were significantly higher than in survivors (15.18±3.17), their overall discrimination power (AUROC 0.798) was statistically lower than that of mNUTRIC. This trend echoes findings across various ICU settings: APACHE II, while reliable for general physiological screening, lacks the specificity required for sepsis–specific outcomes, where nutritional depletion and chronic physiological reserve are pivotal factors.[15–16]

The physiological rationale for mNUTRIC's superiority lies in the complex metabolic response to sepsis. Sepsis triggers a profound hypermetabolic and catabolic state.[2] The systemic inflammatory response induces a massive release of pro–inflammatory cytokines, leading to rapid skeletal muscle wasting, autophagy, and metabolic exhaustion. Patients entering the ICU with a high mNUTRIC score—reflecting advanced age, higher comorbidity (via the APACHE II component), and pre–existing physiological stress, lack the "nutritional and metabolic reserve" required to survive this catabolic storm.[23]

Malnutrition in sepsis is not merely a lack of caloric intake; it is a primary driver of multi–organ immune dysfunction. Malnourished patients exhibit impaired cellular immunity, reduced antioxidant capacity, and increased intestinal permeability.[23–25] This "leaky gut" phenomenon facilitates the translocation of intestinal flora and toxins into the bloodstream, further fueling the inflammatory cascade and increasing the risk of secondary nosocomial infections.[25]

Furthermore, malnutrition leads to hypoalbuminemia, which drastically alters the pharmacokinetics and pharmacodynamics of life–saving interventions. In septic patients, low albumin levels increase the volume of distribution and the clearance of protein–bound antibiotics (such as beta–lactams or glycopeptides), potentially leading to sub–therapeutic drug concentrations during the critical "golden hours" of treatment.[26] While APACHE II focuses primarily on acute physiological derangements (e.g., heart rate, MAP, and temperature), it fails to account for these vital chronic and nutritional vulnerabilities.[21–22] The mNUTRIC score bridges this gap by combining acute severity (as measured by SOFA and APACHE II) with chronic health status, providing a more holistic "snapshot" of the patient's resilience.[6]

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From a clinical standpoint, the mNUTRIC score is highly advantageous due to its feasibility in a resource–limited setting. Unlike the original NUTRIC score, the "modified" version utilized in this study does not require Interleukin–6 (IL–6) measurements.[6] In many tertiary centers, routine IL–6 testing is often unavailable or cost–prohibitive for daily screening. All variables for mNUTRIC can be retrieved directly from standard medical records without necessitating direct patient or family interviews, which can be challenging in sedated or intubated patients.[9]

Our data showed that the mNUTRIC score was more accurate in identifying true survivors (19 vs 17 by APACHE II) and true non–survivors (12 vs 11). This enhanced accuracy allows intensivists to prioritize aggressive interventions better and allocate limited ICU resources more effectively. Early identification of high–nutritional–risk patients enables targeted nutritional therapy, such as early enteral nutrition or parenteral supplementation, which has been shown to reduce the metabolic response to stress, prevent oxidative cellular damage, and improve long–term ICU outcomes. [19–20]

Despite its significant findings, this study has several limitations. The relatively small sample size (n=39) may reduce statistical power and limit the precision and generalizability of the results. Although discrimination analysis demonstrated statistically significant differences, the confidence intervals should be interpreted cautiously. Therefore, the findings should be considered preliminary and require validation in larger, multicenter studies to confirm the robustness of mNUTRIC as a prognostic tool.

Conclusion

In conclusion, the mNUTRIC score demonstrated greater discrimination than the APACHE II score for predicting 28–day mortality in septic ICU patients in this study. A mNUTRIC cut–off ≥5 may help identify patients at higher risk of death. However, given the relatively small sample size, further large–scale studies are needed to confirm these findings before routine implementation can be universally recommended.

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