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Original research article

USE OF NUTRIENT RISK IN CRITICALLY ILL SCORE TO ASSESS NUTRITIONAL RISK IN MECHANICALLY VENTILATED PATIENTS

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Abstract: *Ensuring proper nutritional support is crucial for critically ill patients. This nutritional deficit is closely associated with heightened susceptibility to nosocomial infections, delayed wound healing, and an escalated risk of mortality.* ***Objective:*** *The objective of this study is to evaluate the effectiveness of the Nutrient Risk in Critically Ill (NUTRIC) score in assessing the nutritional risk of mechanically ventilated patients.* ***Method:*** *It is a cross-sectional study. It is conducted at the Department of Critical Care Medicine, Shifa International Hospital, Islamabad from 1st Jan 2024 to 30 May 2024. The calculated sample size was 381 selected by non-probability consecutive sampling. The study utilized the modified Nutritional Risk in the Critically Ill (mNUTRIC) score to assess nutritional risk in mechanically ventilated (MV) patients. Data will be analyzed using SPSS 24.0. A P value of ≤ 5 will be significant* ***Result:*** *The study included a total of 381 participants, with a mean age of 55.7 ± 17.5 years and, a BMI was 23.7 ± 3.5. 219 (57.48%) had low nutritional risk (NUTRIC score ≤4), while 162 (42.51%) had high nutritional risk (NUTRIC score ≥5). Patients in the high nutritional risk group had a longer stay in the intensive care unit (ICU), had fewer ventilator-free days and had higher mortality rates compared to those in the low nutritional risk group (8.5 ± 4.1 days vs. 5.2 ± 3.9 days, p-value < 0.01).* ***Conclusion:*** *The study highlights the significance of the NUTRIC score as a valuable tool for the estimation of nutritional risk among mechanically ventilated patients in the ICU setting*

Keywords: Nutritional Risk, Critically Ill Patients, Mechanical Ventilation, Intensive Care Unit (ICU), NUTRIC Score

Introduction

Ensuring proper nutritional support is integral to the comprehensive care of critically ill patients. The prevalence of malnutrition, ranging from 38% to 49%, is contingent on the screening tool applied (1, 2). This nutritional deficit is closely associated with heightened susceptibility to healthcare-associated infections, compromised rates of wound healing, and an escalated risk of mortality (3, 4). The nutritional well-being of individuals admitted to an intensive care unit (ICU) is intricately shaped by both chronic and acute states of inadequate nourishment. These conditions trigger diverse catabolic processes, encompassing not only the depletion of body mass (5-7). In essence, addressing the nutritional needs of critically ill patients is pivotal for mitigating the adverse consequences linked to malnutrition, encompassing both immediate and chronic ramifications on health outcomes.

Mechanically ventilated patients in intensive care units (ICUs) often experience altered metabolism, increased energy expenditure, and impaired gastrointestinal function, resulting in increased risk of malnutrition and adverse clinical outcomes. Researches have shown that despite strict adherence to guidelines, nearly 29% of mechanically ventilated patients receive adequate nutrition, with airway-related procedures and GI intolerance being common reasons for inadequacy (8). This happens due to the fact that energy expenditure increases in septic shock patients, but calorie intake and predictive equations cannot accurately meet their daily energy needs (9). However, adequate nutritional support protocols in ICU patients lead to earlier enteral nutrition, early weaning from ventilator, shorter hospital stays, and lower complications and mortality rates (10). Assessing the nutritional status and risk in these patients is crucial for guiding appropriate interventions and optimizing patient outcomes (11).

Various scoring systems, criteria, and tools, such as physical examination, dietary intake, severity of illness, functional assessment, and anthropometric data, are employed in hospital settings to assess nutritional risk (12). However, assessing patients who are mechanically ventilated and sedated presents certain challenges. Factors like fluid status and edema can influence weight changes, and substantial fluid resuscitation may be required to maintain hemodynamics, complicating the evaluation of muscle and fat wasting (13, 14). Recognizing that not all ICU patients share the same nutritional risk, Heyland et al. introduced the Nutrition Risk in Critically Ill (NUTRIC) score. The mNUTRIC score effectively predicts poor clinical outcomes in mechanically ventilated patients in ICUs, aiding nursing practice by identifying high-risk patients within 48 hours of admission (15).

There is a scarcity of studies evaluating the suitability and efficacy of various nutritional assessment tools, including the NUTRIC score, in the Pakistani population of mechanically ventilated patients. Studies evaluating the effectiveness of nutritional interventions, such as enteral or parenteral nutrition, in mechanically ventilated patients in Pakistan are also scarce. Pakistan faces challenges related to healthcare infrastructure and resource availability, which can impact the delivery of nutritional support in critically ill patients (16). Moreover, many validation studies of the NUTRIC score have been retrospective or observational in

nature, limiting the ability to establish causality or assess long-term outcomes. While the NUTRIC score is widely used, comparative studies with other nutritional assessment tools commonly employed in ICU settings are scarce (17).
The current study aims to determine the prevalence of nutritional risk in mechanically ventilated ICU patients based on NUTRIC score. This study aims to evaluate the effectiveness of the Nutrient Risk in Critically Ill (NUTRIC) score in assessing nutritional risk among mechanically ventilated patients admitted to the intensive care unit (ICU). The primary objective is to determine the correlation between NUTRIC scores and clinical outcomes, including mortality rates, length of ICU stay, and incidence of complications such as infections and organ dysfunction.

Methodology

It is a cross-sectional study conducted at Department Of Critical Care Medicine, Shifa International Hospital, Islamabad from 1st Jan 2024 to 6th June, 2024 after taking approval from the ethical review committee. All the mechanically ventilated patients with age 20 to 90 years, Male or female admitted at Department Of Critical Care Medicine, Shifa International Hospital, Islamabad were included in this study. Patients who have received significant nutritional support or readmitted in ICU were included in this study. Patients under palliative care or deemed to have a terminal illness, as their nutritional status might not be representative of the general critically ill population and patients discharged or died within 48 hours from their arrival in ICU were also excluded. The sample size was calculated by using World Health Organization (WHO) software, 95% Confidence Interval, 5 % margin of error and anticipated proportion of mechanically ventilated patients at nutritional risk is 0.45% [18]. The calculated sample size was 381 selected by non-probability consecutive sampling.
The informed consent was taken in writing from the guardian. Patients fulfilling the inclusion criteria from Department of Critical Care Medicine, Shifa International Hospital, Islamabad will be included in the study. The study utilized the modified Nutritional Risk in the Critically Ill (mNUTRIC) score to assess nutritional risk in mechanically ventilated (MV) patients. The score was derived from age, number of comorbidities, days from hospital to ICU admission, and Acute Physiology and Chronic Health Evaluation II (APACHE II) and Sequential Organ Failure Assessment (SOFA) scores at admission. Patients with a mNUTRIC score ≥5 were categorized as high risk for malnutrition, while those with a score ≤4 were classified as low risk. ICU physicians performed NUTRIC scoring for all MV patients. Data collection encompassed demographic information, parameters essential for NUTRIC score calculation, ICU average length of stay (ALOS), ventilator-free days, and mortality outcomes.
During the design phase, the confounding factors will be addressed using restriction. Using strict inclusion criteria, only those patients who comply with inclusion criteria will be added to the study. After data collection, propensity scoring will be done to minimize the selection bias and decrease the effect of confounding variables.
Data will be analyzed using SPSS 24.0. Quantitative variables like age and days in the hospital, will be described as mean + standard deviation. Categorical variables like gender, comorbidities, shock and respiratory failure will be described as frequencies and percentages. Data will be stratified by co-morbidities and reason for intubation. To know the significant correlation between different variables, a chi-square test at a 5% significant level will be used. A p-value of ≤ 5 will be considered statistically significant.

Results

The study included a total of 381 participants, with a mean age of 55.7 ± 17.5 years. The average BMI (Body Mass Index) was 23.7 ± 3.5. The gender distribution among the participants was as follows: 239 males (62.73%) and 142 females (37.27%). Regarding co-morbidities, hypertension was the most prevalent condition, affecting 117 participants (30.71%), followed by diabetes in 108 participants (28.35%). Chronic renal failure was observed in 33 participants (8.7%), while neurological disease affected 39 participants (10.24%). Other co-morbidities included coronary artery disease (18 participants, 4.7%), chronic obstructive airway disease (42 participants, 11.02%), hepatic failure (19 participants, 4.98%), and malignancy (5 participants, 1.31%). The primary indications for mechanical ventilation were respiratory failure in 193 cases (50.65%), shock in 128 cases (33.59%), and neurological deterioration in 60 cases (15.75%) (Table 1, Figure 1). These findings provide insight into the demographic characteristics, co-morbidities, and indications for mechanical ventilation among the participants in the study.
The study included a total of 381 patients, among whom 219 (57.48%) were classified as having low nutritional risk (NUTRIC score ≤4), while 162 (42.51%) were categorized as having high nutritional risk (NUTRIC score ≥5). A comparison of key variables between the low and high-nutritional risk groups revealed significant differences. The mean NUTRIC score was notably higher in the high nutritional risk group (6.0 ± 0.9) compared to the low nutritional risk group (2.6 ± 1.4), with a p-value of less than 0.02. Similarly, differences were observed in other scoring systems such as the Acute Physiology and Chronic Health Evaluation (APACHE) score and Sequential Organ Failure Assessment (SOFA) score, with higher values recorded in the high nutritional risk group (p-values of 0.01 and 0.03, respectively) (Table 2, Figure 2).
Moreover, patients in the high nutritional risk group had a longer average length of stay in the intensive care unit (ICU) compared to those in the low nutritional risk group (8.5 ± 4.1 days vs. 5.2 ± 3.9 days, p-value < 0.01). Additionally, the high nutritional risk group had fewer ventilator-free days compared to the low nutritional risk group (1.7 ± 0.9 days vs. 2.6 ± 1.4 days, p-value of 0.03). Mortality rates were significantly higher in the high nutritional risk group (43.8%) compared to the low nutritional risk group (26.1%), with a p-value of 0.01, indicating a potential association between nutritional risk and patient outcomes.

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Table 1: Demographic characteristics, co-morbidities, and indications for mechanical ventilation among the participants in the study

Variable	Results
Age (years) (mean ± SD)	55.7 ± 17.5
BMI (height / m²)	23.7 ± 3.5
Gender	
Male	239 (62.73%)
Female	142 (37.27%)
Co-morbidities	
Hypertension	117 (30.71%)
Diabetes	108 (28.35%)
Chronic renal failure	33 (8.7%)
Neurological disease	39 (10.24%)
Coronary artery disease	18 (4.7%)
Chronic obstructive airway disease	42 (11.02%)
Hepatic failure	19 (4.98%)
Malignancy	5 (1.31%)
Indication of mechanical ventilation	
Respiratory failure	193 (50.65%)
Shock	128 (33.59%)
Neurological deterioration	60 (15.75%)

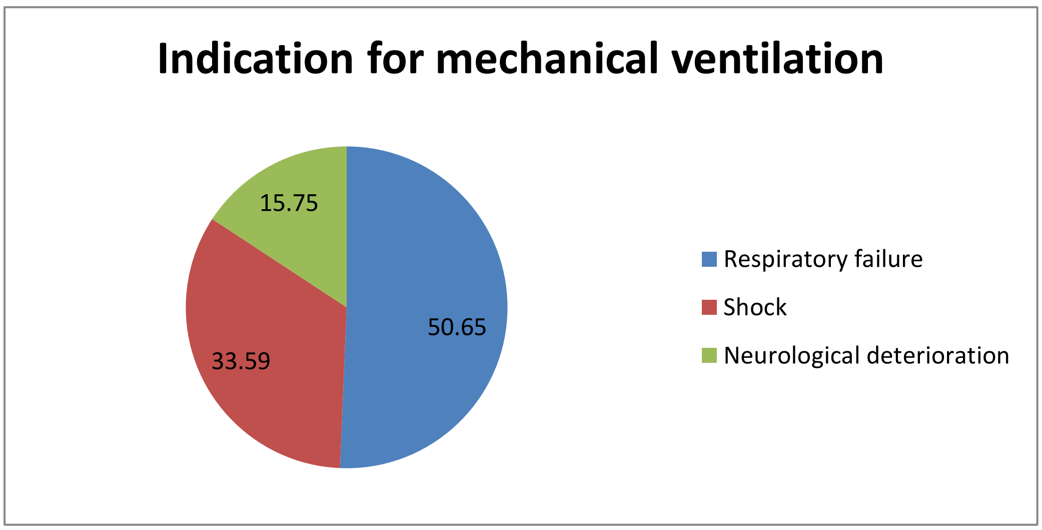

Figure 1: Indication of mechanical ventilation

Table 2: Assessment of variables in the study population

Variables	Low risk (NUTRIC score ≤4) n=219 (57.48%)	High risk (NUTRIC score ≥5) n=162 (42.51%)	Total patients (n=381)	P value
NUTRIC score	2.6 ± 1.4	6.0 ± 0.9	3.9.± 2.1	<0.02
APACHE score	18.4 ± 5.7	21.3 ± 6.4	22.0 ±7.3	0.01
SOFA score	3.5 ± 2.9	5.9 ± 4.7	6.1 ± 3.9	0.03
ICU average length of stay days	5.2 ± 3.9	8.5 ± 4.1	8.3 ± 4.6	<0.01
Ventilator free days	2.6 ± 1.4	1.7 ± 0.9	2.5 ± 1.9	0.03
Mortality (%)	26.1	43.8	41.7	0.01

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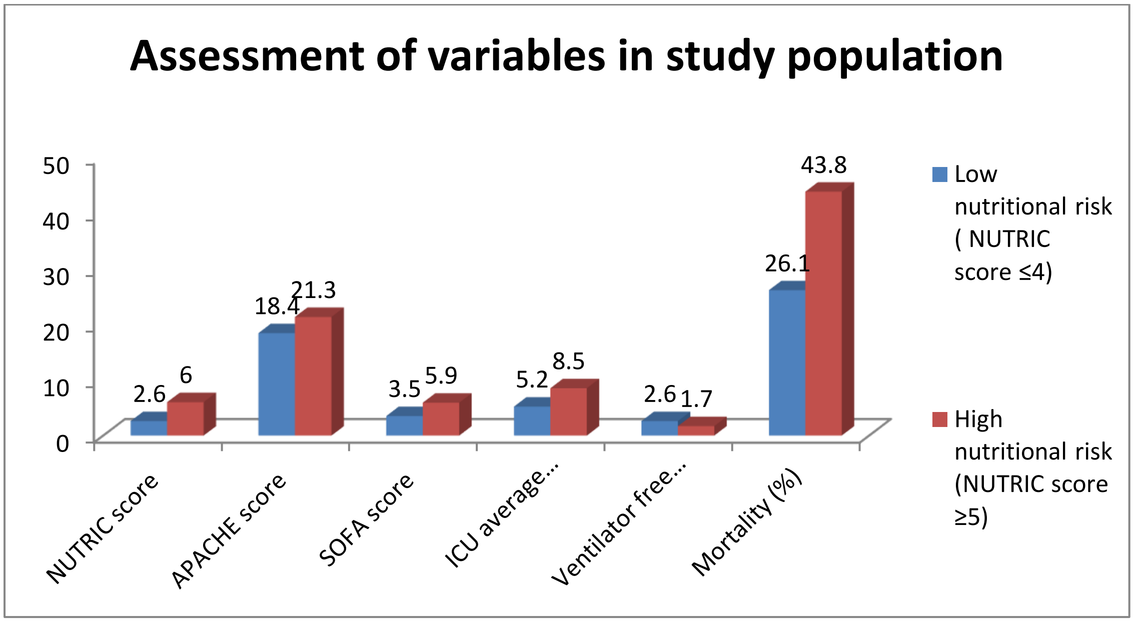

Figure 2: Assessment of variables in the study population

Discussion

The study aimed to assess the impact of nutritional risk, as measured by the NUTRIC score, on various clinical outcomes in critically ill patients (18). The findings, based on a cohort of 381 patients, revealed significant differences between those classified as having low versus high nutritional risk. The analysis demonstrated that patients in the high nutritional risk group exhibited significantly higher mean NUTRIC scores compared to those in the low nutritional risk group. These patients have also reported longer stays in the intensive care unit (ICU) and fewer ventilator-free days. This observation aligns with the expected trend, as a higher NUTRIC score indicates increased nutritional risk and correlates with worse outcomes. Furthermore, the study revealed significant disparities in key clinical variables between the two groups. Patients classified as high nutritional risk demonstrated higher scores on other prognostic tools. These findings suggest a potential interplay between nutritional status overall disease severity and organ dysfunction. These findings correlate with previous literature suggesting that the NUTRIC score can identify patients at high risk of malnutrition (15).

Perhaps most strikingly, the study identified a significant disparity in mortality rates between the low and high-nutritional-risk groups, with mortality being substantially higher among patients classified as high nutritional risk. This finding underscores the clinical relevance of assessing and addressing nutritional status in critically ill patients, as it appears to be intricately linked to patient outcomes and survival. Literature has recommended using the NUTRIC score as it is an appropriate tool for nutritional risk assessment and prognosis prediction of NICU patients (19, 20).

The study has a limited sample size and single-center design. The study highlights the importance of identifying patients at high nutritional risk, as they are more likely to experience adverse clinical outcomes. The findings of this study can inform clinical decision-making processes regarding nutritional support in mechanically ventilated patients (21). For instance, patients identified as high nutritional risk may benefit from early and aggressive nutritional interventions, such as enteral or parenteral nutrition, to mitigate the risk of complications and improve outcomes. This study also has certain limitations. Understanding the effect of interventions such as enteral or parenteral nutrition on nutritional risk and clinical outcomes would provide valuable insights into optimizing patient care. While the study assessed several clinical outcomes other important endpoints, such as quality of life or functional status, were not evaluated. Including a broader range of outcome measures would provide a more comprehensive assessment of the impact of nutritional risk on patient well-being (22).

Conclusion

The study highlights the significance of the NUTRIC score as a valuable tool for assessing nutritional risk among mechanically ventilated patients in the ICU setting. By identifying patients at higher risk and implementing appropriate interventions, healthcare providers can potentially improve patient outcomes and optimize care delivery in this vulnerable population

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
Approved by the department concerned. (IRB-SIHIS-52474 dated 10-09-22)
Consent for publication
Approved

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Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

Authors Contribution

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Drafting & Concept
JAFFAR KHAN (Critical Care Fellow)
Design of Study

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