ORIGINAL RESEARCH PAPER

General Medicine

TO STUDY NUTRITIONAL ASSESSMENT AND IMPACT OF MODIFIED-NUTRIC SCORE (m-NUTRIC) IN VENTILATED PATIENTS

KEY WORDS: Mechanically ventilated patients, Nutrition Risk in Critically ill score, nutritional assessment

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ABSTRACT

BACKGROUND: In critically ill patients, nutrition status is closely linked with clinical outcomes. However, determination of nutrition status in critically ill patients is not a straightforward process. Because of inability to provide history of food intake and weight loss traditional scoring systems cannot be used for screening in mechanically ventilated (MV) patients The modified Nutrition Risk in Critically ill (mNUTRIC) score is the appropriate nutritional assessment tool in MV patients.

OBJECTIVES: To study the prevalence and Impact of nutritional risk in mechanically ventilated ICU patients with modified NUTRIC (m-NUTRIC) score on morbidity [ICU average length of stay (ALOS), ventilator free days (VFDs)] and mortality.

PATIENTS AND METHODS: All adult patients age >18 years was admitted to the medical ICU and required mechanical ventilation for more than 48 hrs was included in the study. Data were collected on variables required to calculate mNUTRIC score. Patients with mNUTRIC score ≥5 are considered at nutritional risk. Outcome data were collected on ICU length of stay, ventilator-free days, and mortality up to 28 days.

RESULTS: A total of 100 (63 males and 37 females) patients were included those fit for inclusion criteria. The mean age was 59.12 years, 69% of mechanically ventilated patients had mNUTRIC scores ≥5, had morbidity {longer ALOS (mean ± SD = 11.75±3.00 days) and less VFDs as compared with 6.48±1.36 days in patients with mNUTRIC scores ≤4 and a higher mortality rate (61%). A high mNUTRIC predicted mortality score shows a receiver operating characteristic curve of from this we found 0.891 sensitivity of 88.4%, specificity of 74.2%.

CONCLUSIONS: High mNUTRIC score (>.5) was associated with increased ICU length of stay, less VFDs and higher mortality.

INTRODUCTION

Nutritional support is an essential component of the care of critically ill patients. The prevalence of malnutrition varies between 39% and 50% depending on the screening tool employed and the population studied[1-2]. These nutritional deficiencies are associated with high rates of nosocomial infections, impaired wound healing rates, and high mortality rates[3-4]. The nutritional status of patients admitted to an intensive care unit (ICU) is influenced by both chronic and acute starvation, which can lead to many catabolic processes such as loss of body mass and single and multiple organ failure[5-7].

Nutritional assessment is the cornerstone in identifying patients at risk of malnutrition and it has to be done within 48 h of hospital admission. A number of nutritional assessment tools are available for screening patients and they use various criteria to identify patients at nutritional risk including anthropometric data, physical examination, history of weight loss, dietary intake, and clinical diagnosis.[8-10] Most of the nutritional screening tools available are validated in hospitalized patients; no specific tool is available for ICU patients.[11] Nutritional screening in ICU patients is challenging because many of the parameters such as accurate history of dietary intake and weight loss may be difficult to obtain, as most of the patients are on mechanical ventilation and sedation. Changes in weight can be influenced by the edema due to underlying disease and large volume fluid resuscitation required to maintain hemodynamic stability, consequently muscle and fat-wasting evaluation becomes more difficult. Many of the nutritional tools available do not include inflammatory process and hypermetabolic status in ICU patients.

Based on an assumption that all ICU patients do not have the same nutritional risk, Heyland et al. introduced the Nutrition Risk in Critically Ill (NUTRIC) score. This can be used to identify patients who will benefit from aggressive nutritional support according to their risk of malnutrition.[5,6] In mechanically ventilated patients, nutritional assessment is cumbersome, as their dietary history may be difficult to obtain, and rates of muscle wasting can give a false impression due to edema. Data on nutritional assessment in mechanically ventilated patients using NUTRIC scores are limited.[7] The present study was conducted to identify the prevalence of nutritional risk in mechanically ventilated ICU patients based on modified NUTRIC (mNUTRIC) scores.

MATERIAL & METHODS

The prospective observational study was conducted in Department of General Medicine, Medical ICU & EMU at J.L.N. Medical College and Associated Group of Hospitals, Ajmer using m-NUTRIC score (without using IL-6 values) to identify patients at nutritional risk with following – Variables: age, number of comorbidities, days from hospital to ICU admission and acute physiology and chronic health evaluation (APACHE-II) and sequential again failure assessment (SOFA) scores at admission. Patients was classified as having a high m-NUTRIC score if the sum was ≥5 and these patients were classified as having a higher risk of malnutrition ,if low score m-NUTRIC ≤4 then patients were classified low risk of malnutrition. Data collection was done on demography, parameter required to calculate NUTRIC- scores, ICU average length of stay (ALOS), ventilator free days and mortality. All adult patients age >18 years was admitted to the ICU and required mechanical ventilation for more than 48 hrs was included in the study. Patients was readmitted to the ICU during the same hospital admission and transformed to other ICU/hospitals was excluded from the analysis.

METHODS OF COLLECTION OF DATA AND STATISTICAL ANALYSIS:

Collected data was analysed with IBM, SPSS (IBM Corp., statistics for windows, version 23.0 Armonk, Ny). Continuous variables were expressed as mean ± standard deviation and categorical data/variables were expressed as percentage. To find the significant difference between bivariate samples in independent groups – unpaired sample t-test was used and chi-square test used to find the significance in categorical data. The receiver operator characteristic curve analyses was used to find the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) on comparison of outcome and nutric score. The data were recorded from patient charts (electronic and/or paper) using a standardized data collection procedure developed for this study (APACHE II and SOFA scores and a mNUTRIC score chart attached to patient records).

Ventilator free days (VFD) are defined as follows: "one point [for] each day during the measurement period that [patients] are both alive and free of mechanical ventilation. A patient who is extubated on Day 2 of the study and remains alive and free of the ventilator for the remainder of the 28-day study period would receive a VFD score of 26, whereas the patient who is ventilated until death on Day 2 would receive a score of zero". VFDs are now widely used as an outcome in randomized controlled trials (RCTs) and are also advised as a potential primary end point.[21] In all analyses, p = 0.05 was considered statistically significant.

RESULTS

A total of 100 MV (>48 h) patients were admitted to the ICU during the study period. Out of 100 patients most of patients were male 63% followed by 37% were females. Table 1 summarizes the main characteristics of the patients that were included in the study. The majority of patients had a medical history including septicemia (49%), Diabetes mellitus (47%), Hypertension (46%), Ischemic heart disease (26%) and coronary kidney disease (17%) and out of our studied subjects majority of symptoms including Fever (90%), cough (39%) and Dyspnea & Gastrointestinal (36%).

Table – 1	
Age (Years), Mean ± SD	59.12±16.72
Male	63%
Female	37%
Comorbidities	
Septicemia	49(49%)
DM	47(47%)
HTN	46(46%)
IHD	26(26%)
CKD	17(17%)
COPD	9(9%)
CLD	5(5%)
Neurological	15(15%)
Others	12(12%)
Symptoms	
Fever	90%
Cough	39%
Dyspnea	36%
Gastrointestinal	36%
Burning Micturition	24%
Others	46%

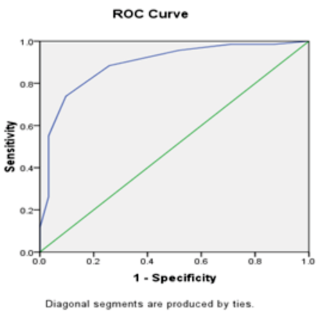
Mean Age of all patients was 59.12±16.72. Mean APACHE II and SOFA scores of these patients were 24.92 ± 9.40 and 8.96±3.49, respectively [Table 2]. Mean ICU length of stay and ventilator-free days were 10.12±3.57 and 6.89±9.82 days, respectively. Mortality was 61% patients were at high nutritional risk (mNUTRIC score ≥5). Patients with high mNUTRIC score ≥5 had longer mean ICU ALOS of 11.75±3.00 versus 6.48±1.36 days (P < 0.001) and higher mortality of 61% versus 8% (P< 0.001) compared to patients with low NUTRIC score (≤4) [Table 2]. Ventilator free days had longer mean of 16.19±9.57 with mNutric score ≤4 as compare to high nutric score ≥5 i.e. 2.71±6.54. Patients with high mNutric score ≥5 had longer mean BMI of 26.86±5.08 versus 26.12±4.85 height/m2 (P =0.49) with low NUTRIC score (≤4)

Table – 2

Para meter	All patients	NUTRIC Score ≤4	NUTRIC Score ≥5	P Value
Age	59.12± 16.72	50.35±14.46	63.05± 16.25	0.003
NUTRIC Score	5.56 ± 2.16	2.93± 1.12	6.73± 1.29	0.001
APACHE Score	24.92 ± 9.40	15.02±5.71	29.36± 7.04	0.001
SOFA	8.96 ± 3.49	6.22± 2.59	10.18± 3.13	0.001
BMI (height/ m2)	26.64 ± 5.00	26.12±4.85	26.86± 5.08	0.49
Ventilator free days	6.89 ± 9.82	16.19±9.57	2.71± 6.54	<0.01
ICU ALOS days	10.12 ± 3.57	6.48± 1.36	11.75± 3.00	0.001
Mortality	69%	8%	61%	0.001

High mNUTRIC score (≥5) predicted mortality with area under the curve (AUC) of 0.891 with a sensitivity of 88.4%, specificity of 74.2%.

Fig. 2



DISCUSSION

In present study there were 63% males and 37% females with male to female ratio was 1.7:1. Out of them majority of patients of patients 42.8% males and 48.6% females in age group 61-80 years followed by 33.3% males and 29.7% females were in age group 41-60 years , 12.9% males and 10.8% females in age group 21-40 years, 11.1% males and 8.1% females in age group >80 years, and 5.4% females in age group <20 years. Here, in survived patients 29.03% had septicaemia, 29% had diabetes followed by 22.6% had hypertension and ischemic heart disease each, 12.9% had chronic kidney disease, 16.1% had neurological disease, 3.2% had chronic obstructive pulmonary disease and chronic lung disease respectively. In dead patients 57.97% had septicaemia, 56% had hypertension followed by 55.5% had diabetes, 27.5% had ischemic heart disease, 18.8% had chronic kidney disease, 14.5% had neurological disease, 11.6% had chronic obstructive pulmonary disease and 5.8% had chronic lung disease. In survived patients *with 0-1 co-morbidity had 64.51% and Patients with 2 or more co-morbidities had 35.48% and in dead patients with 0-1 co-morbidity had 33.33% and Patients with 2 or more co-morbidities had 66.66% and p value was* 0.0035 which is significant. Ata-ur-Rahman[5] found that Of the 75 patients studied, 40 were male and 35 were female. The majority of patients had a medical history including diabetes mellitus (28%), hypertension (21.3%), chronic renal failure (17.3%), and coronary artery disease. The most common reasons for mechanical ventilation and ICU admission were respiratory failure (30.6%), followed by neurological issues (29.3%), sepsis/shock (26.6%), cardiovascular issues (13.3%), and renal/metabolic issues. Kalaiselvan et al[7] found Mean age of patients was 55.7 years (±17.5) (± SD). Most of the patients were male, i.e., 458 (67.6%). Majority of patients were medical cases and 23% of patients were surgical admissions. Diabetes mellitus (34.8%), hypertension (34.2%), and chronic renal failure (13.5%) were the most common comorbid illnesses. The most common reasons for mechanical ventilation and ICU admissions were respiratory failure (52.5%) followed by shock (20%), neurological deterioration (14.6%), and surgical postoperative patients (12.8%).

Here, we found the area under curve was found 0.891 and from this ROC curve we found a cut off value of 4.5 for m-NUTRIC score to predict its sensitivity and specificity for mortality on full scale (0-9). From this we found sensitivity of 88.4%, specificity of 74.2%. The area under curve was found 0.783 and from this ROC curve we found a cut off value of 5.5 for ≥5mNUTRIC score to predict its sensitivity and specificity for mortality. From this we found sensitivity of 83.6%, specificity of 63.5%. Kalaiselvan et al[7] found that high mNUTRIC score (≥5) predicted mortality with area under the curve (AUC) of 0.582. The PPV and the NPV of NUTRIC score to predict mortality were 47.4% and 68.9%, respectively, with a sensitivity and specificity of 41.5% and 73.8%. mNUTRIC score on a full scale (0-9) predicted mortality with AUC of 0.642. Jeong et al[12] found The area under the curves (AUCs) of the modified NUTRIC Score for predicting 28-,day mortality were 0.757. In the ROC curve of modified NUTRIC score, the best cutoff was at 6 (sensitivity 75% and specificity 65%). Mukhopadhyay et al[13] found the best cutoff was at 5 sensitivity 72% and specificity3%, respectively.

In survived patients mean SOFA score was 5.6±1.5. In dead patients mean SOFA score was 10.4±3.03. The mean m-NUTRIC score in survived patients was 6.4±1.6 and in dead patients mean m-NUTRIC score was 3.5±1.7, The mean APACHE II score in survived patients was 16.7±6.4 and in dead patients was 28.6±8.1. Kalaiselvan et al[7] found Mean APACHE II and SOFA scores of these patients were 22.2 (±7.3) (±SD) and 6.7 (±3.0) (±SD), respectively, In our study Patients having NUTRIC score ≤4 mean APACHE II, mean SOFA, mean ventilator free days, ICU LOS days was 15.02±5.71, 6.22±2.59, 16.19±9.57 days and 6.48±1.36 days. Similarly NUTRIC SCORE ≥5 APACHE II, mean SOFA, mean ventilator free days, ICU LOS days was 29.36±7.04, 10.18±3.13, 2.71±6.54days and 11.75±3.00 days. Ata ur-Rehman et al[5] found the mean APACHE II and SOFA scores of patients with mNUTRIC scores ≤ 4 were 12.7±4 and 4±6 (p< 0.00), respectively. Patients with mNUTRIC scores ≥ 5 had mean APACHE II and SOFA scores of 28.7±6 and 11±7, respectively in terms of outcomes for patients with mNUTRIC scores ≤ 4, the mean length of stay and ventilator-free days were 3.5±4 and 1.0±2, respectively, with a 3% mortality rate. However, patients with mNUTRIC scores ≥ 5 had a longer length of stay and a higher mortality rate of 26%. Kalaiselvan et al[7] found that Patients with high mNUTRIC score ≥5 had longer mean ICU ALOS of 9.0 (±4.2) versus 7.8 (±5.8) mean (± SD) days (P < 0.01) and higher mortality of 41.4% versus 26.1% (P < 0.0) compared to patients with low NUTRIC score (≤4).

CONCLUSION

According to the mNUTRIC scores, 61% of mechanically ventilated patients were at nutritional risk. High mNUTRIC scores were directly proportional to the average length of stay in the ICU and mortality but ventilator free days were inversely proportional i.e. high m-nutric score associated with decrease ventilator free days and higher mortality.

REFERENCES

1. Chakravarty C, Hazarika B, Goswami L, Ramasubban S. Prevalence of malnutrition in a tertiary care hospital in India. Indian J Crit Care Med 2013;17:170 3.
2. Sheean PM, Peterson SJ, Gurka DP, Braunschweig CA. Nutrition assessment: The reproducibility of subjective global assessment in patients requiring mechanical ventilation. Eur J Clin Nutr 2010;64:1358 64.
3. Mendes R, Policarpo S, Fortuna P, Alves M, Virella D, Heyland DK; Portuguese NUTRIC Study Group. Nutritional risk assessment and cultural validation of the modified NUTRIC score in critically ill patients –A multicenter prospective cohort study. J Crit Care 2017;37:249.
4. Correia MI, Waitzberg DL. The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis. Clin Nutr 2003;22:235 9.
5. Rahman A, Hasan RM, Agarwala R, Martin C, Day AG, Heyland DK: Identifying critically-ill patients who will benefit most from nutritional therapy: further validation of the "modified NUTRIC" nutritional risk assessment tool. Clin Nutr. 2016, 35:158-162. 10.1016/j.clnu.2015.01.015
6. Heyland DK, Dhaliwal R, Jiang X, Day AG: Identifying critically ill patients who benefit the most from nutrition therapy: the development and initial validation of a novel risk assessment tool. Crit Care. 2011, 15:268. 10.1186/cc10546
7. Kalaiselvan M, Renuka M, Arun kumar A: Use of nutrition risk in critically ill (nutric) score to assess nutritional risk in mechanically ventilated patients: A prospective observational study. Indian J Crit Care Med. 2017, 21:253-256. 10.4103/ijccm.IJCCM_24_17
8. Detsky AS, McLaughlin JR, Baker JP, Johnston N, Whittaker S, Mendelson RA, et al. What is subjective global assessment of nutritional status? JPEN J Parenter Enteral Nutr 1987;11:8 13.
9. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z; Ad Hoc ESPEN Working Group. Nutritional risk screening (NRS 2002): A new method based on an analysis of controlled clinical trials. Clin Nutr 2003;22:321 36.
10. Elia M. The 'MUST' report: Nutritional screening of adults: A multidisciplinary responsibility. A report by the Malnutrition Advisory Group of the British Association for Patenteral and Enteral Nutrition (BAPEN). Marinos Elia, British Association for Parenteral and Enteral Nutrition. 2003.
11. van Bokhorst de van der Schueren MA, Guaitoli PR, Jansma EP, de Vet HC. Nutrition screening tools: Does one size fit all? A systematic review of screening tools for the hospital setting. Clin Nutr 2014;33:39 58
12. Jeong DH, Hong SB, Lim CM, Koh Y, Seo J, Kim Y, Min JY, Huh JW. Relationship between Nutrition Intake and 28-Day Mortality Using Modified NUTRIC Score in Patients with Sepsis. Nutrients. 2019 Aug 15;11(8).
13. Mukhopadhyay A, Henry J, Ong V, et al. Association of modified NUTRIC score with 28-day mortality in critically ill patients. Clin Nutr.2017;36(4):1143-1148