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Short Communication

Comparison between Nutric Score and modified nutric score to assess ICU mortality in critically ill patients with COVID-19

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S U M M A R Y

Background and aims: NUTrition Risk in the Critically ill (NUTRIC score) and modified Nutric score (mNUTRIC score) have been validated as screening tool for quantifying risk of adverse outcome in patients admitted in intensive care department. They differ for the measurement of IL-6 levels. In patients with COVID-19 disease the inflammatory response plays a crucial role leading to cytochine storm responsible of multiple organ damage. In this population, levels of IL-6 have been measured as indicator of inflammatory status.

Aim of the study is to compare prognostic performance of both scores in predicting ICU mortality between patients with COVID-19 disease.

Methods: A single centre, retrospective, cohort study on patients admitted in ICU with confirmed diagnosis of COVID-19 was performed. Prognostic performance of NUTRIC score and mNUTRIC score were assessed and compared for discriminative abilities for ICU-mortality.

Results: 43 patients were enrolled, age 64 (55; 70), BMI 28 ± 4. Mean NUTRIC score was 2.5 ± 1, mNUTRIC was 2.6 ± 1.1.

Mortality was 39.5%, all patients had low nutritional risk according to both scores (≤5 and ≤ 4 for NUTRIC and mNUTRIC score respectively). The discriminative ability of Nutric Score for ICU mortality was 0.675 (95% CI: 0.524–0.825), while that of mNutric score was 0.655 (0.513–0.861), p = 0.667.

Conclusions: Prognostic performance of Nutric score and mNutric score is comparable, but the discriminative ability is low even in patients with high inflammatory status as in COVID-19 affected population. These scores may not be appropriate in patients with COVID-19 for the determination of nutritional risk.

1. Introduction

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has been identified as causative agent of pneumonia at the end of 2019 [1]. Various fatal complications have been described including organ failure, septic shock, severe pneumonia, and Acute Respiratory Distress Syndrome (ARDS) [2]. The most severe cases needed admission in the Intensive Care Unit (ICU).

ARDS is a catabolically stressed state due to systemic inflammatory response, multiple organ dysfunction, hypermetabolism, infectious complications and malnutrition [3].

Nutritional support is essential in the management of critically ill patients and should be taken into consideration for all patients staying in the ICU, more so for those staying longer than 48 h and for those at higher nutritional risk, as assessed through general clinical assessment, laboratory tools and scores [4].

The first nutritional risk assessment tool developed and validated for ICU patients is the NUTrition Risk in the Critically Ill score (NUTRIC), composed by age, number of comorbidities, days from hospital to ICU admission, SOFA (Sequential Organ Failure Assessment), APACHE II (Acute Physiology and Chronic Health Evaluation) and Interleukin-6 level (IL-6) as an optional variable [5]. Aim of this score is discriminating between patients at low nutrition risk (points 0–5) and patients at high risk (points 6–10), as the latter might benefit the most from nutritional therapy.

A further, simplified score called Modified NUTRIC score (mNUTRIC) has been introduced to overcome measurement of IL-

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6, not always available [6]. The cutoff points 0–4 define "low risk", the cutoff points 5–9 are "high scores", associated with worse clinical outcomes in terms of mortality and mechanical ventilation.

Aim of this study was therefore to compare NUTRIC score and mNUTRIC scores as nutritional screening tools in patients affected from COVID-19 related ARDS, in whom the inflammatory status seems to play a key role. Secondary outcome was to investigate the ability of the scores in predicting ICU mortality and their relationship with length of ICU stay (LOS).

2. Materials and methods

2.1. Enrollment criteria

A retrospective observational study was conducted in the ICU department of "San Carlo Borromeo" Hospital, Milan. Between 1st of March 2020 and 30th of April 2020, patients with confirmed infection, defined as positive reverse transcriptase-polymerase chain reaction (RT-PCR) from a naso-pharingeal swab associated with symptoms, signs, and radiological findings suggestive of COVID-19 pneumonia, were admitted. The local ethics committee approved the study, and consent was obtained according to Italian regulations.

2.2. Data collection

NUTRIC and mNUTRIC scores were calculated at admission. Patients were then divided into two groups according to their nutritional risk: high risk for points ≥6 or ≥5 of NUTRIC and mNUTRIC respectively and low risk for NUTRIC ≤5 or mNUTRIC ≤4.

Calorie and protein intake on the second and fifth ICU day were collected. Calculations were based on actual body weight at admission.

According to the American Society for Parenteral and Enteral Nutrition (ASPEN) recommendations for nutritional management of COVID-19 patients, nutritional targets were 15–20 kcal/kg/die (70–80% of energy requirements) and 1.3 g/kg/die for proteins [7].

For obese patients (BMI>30 kg/m^2), 1.3 g/kg "adjusted body weight" protein equivalents per day was considered as target.

2.3. Statistical analysis

Continuous variables are presented as mean and standard deviation (SD) if normally distributed or medians (25th; 75th quartile) if not, categorical variables as percentage. Normality of continuous variables has been assessed through Shapiro Wilks test and p-value <0.05 was considered statistically significant.

The accuracy in predicting ICU mortality was assessed by the area under the receiver operating characteristic (ROC) curve for both the NUTRIC Score and mNUTRIC Score.

Linear regression was used to test relationship between length of stay and NUTRIC/mNUTRIC score.

Variables were compared between each dichotomized group (survivors/non survivors) using *t*-test, Mann–Whitney *U* and Chi-square testing where appropriate.

All statistical analysis were conducted using R (R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/).

3. Results

During the study period, 43 patients had IL-6 levels tested and were included in the study. Table 1 shows demographic and clinical admission variables.

Table 1
Demographic and Clinical characteristics of patients in the first 24 h of ICU admission.

Variables	All patients (n = 43)
Age	64 (55;70.5)
Gender	
Female	9 (21%)
Male	34 (79%)
Baseline APACHE II	7 (5; 10)
Baseline SOFA	4 (3; 6)
BMI (kg/m^2)	27.6 ± 4.1
IL-6 (ng/L)	84 (24; 173)
NUTRIC score	3 (2; 3)
mNUTRIC score	3 (2; 3)
Weight at admission (kg)	84.5 (70; 88)
ABW	72.7 ± 10.9
IBW	66.5 ± 10.3
Energy intake at 48 h from admission	
(kcal/die)	1466 (1220; 1692)
(kcal/kg/die)	18 (15; 22.6)
Protein intake at 48 h from admission	
(g/die)	63 (40; 71)
(g/kg/die)	0.8 (0.6; 1)
Energy intake at 5th day from admission	
(kcal/die)	1875 (1500; 1875)
(Kcal/kg/die)	22 (16.4; 23.4)
Protein intake at 5th day from admission	
(g)	94.5 (63; 94.5)
(g/kg/die)	1.1 (0.9; 1.3)
Nitrogen Balance (g/N/die)	−11.2 ± 9.4
Day of nitrogen balance from admission	5 (4; 7)
PaO2/FiO2 at admission	119 (92; 162)
PEEP at admission	14 (12; 15)

All patients admitted in the ICU received early enteral nutrition (100% within 48 h).

Mortality in this selected population was 39.5%, survivors were 26 (60.5%), were younger (59 ± 10 vs. 68 ± 7 years, p = 0.003)

Table 2
Patients stratified by survival.

Variable	ICU survivors N = 26 (60.5%)	ICU non-survivors N = 17 (39.5%)	P-value
Age (years)	59.0 ± 9.9	67.5 ± 6.7	**0.002**
Male sex	19 (73.1%)	15 (88.2%)	0.232
Adjusted body weight (kg)	73.6 ± 12.6	71.5 ± 7.6	0.501
Ideal body weight (kg)	67.0 ± 11.3	65.7 ± 8.8	0.667
BMI (kg/m^2)	27.7 ± 4.5	27.5 ± 3.9	0.872
Serum sodium (mMol/L)	141.1 ± 3.6	140.7 ± 4.9	0.768
Blood urea (mg/dL)	47 ± 34	53 ± 22	0.504
IL6 (ng/L)	53 [12;109]	152 [78;264]	**0.020**
APACHE II (points)	7 [5;11]	8 [7;10]	0.455
SOFA (points)	4 [3;5]	4 [3;6]	0.351
Nutric (points)	2 [2;3]	3 [2;3]	**0.043**
mNutric (points)	2 [2;3]	3 [2;3]	0.057
Energy intake at 48 h from admission			
(kcal/day)	1446 [1168;1692]	1483 [1250;1682]	0.330
(kcal/kg)	18 [13.7;24.1]	19 [16;20.7]	0.425
Protein intake at 48 h from admission			
(g/day)	60 [40;75]	63 [62;87]	0.657
(g/kg)	0.7 [0.5;1]	0.8 [0.7;1]	0.056
Energy intake at 5th day			
(Kcal/day)	1875 [1500;1875]	1875 [1500;1875]	0.646
(Kcal/kg/day)	21.3 [15.5;23.4]	22 [17;23.4]	0.715
Protein intake at 5th day			
(g/day)	94.5 [63;94.5]	94.5 [75.6;94.5]	0.892
(g/kg/die)	1 [0.9;1.2]	1.3 [0.8;1.3]	0.471
Nitrogen balance (g N)	−12 ± 11	−10±-6	0.837
PaO2/FiO2 admission	133 [104;166]	100 [88;131]	0.060
PEEP admission	14 [12;15]	14 [12;15]	0.393

Bold are values statistically significant (p value < 0.05).

and had lower IL-6 levels (53 [12–109] vs 152 [78–264] ng/L, p = 0.020) than non survivors [Table 2]. Although all patients had low nutritional risk according to NUTRIC and mNUTRIC scores, survivors had a lower NUTRIC score (2 [IQR 2–3] vs 3 [IQR 2–3], p = 0.043); even though not reaching the statistical significance, similar results were found for the modified NUTRIC score (2 [IQR 2–3] vs 3 [IQR 2–3], p = 0.057).

The overall discriminative ability of NUTRIC score for predicting mortality in ICU was 0.675 (95% CI 0.524–0.825), while mNUTRIC showed an AUC of 0.655 (95% CI 0.513–0.861). The discriminative ability of the two scores was not statistically different (p = 0.667) [Fig. 1].

Median ICU length of stay of the whole population was 11 (8–19) days; ICU survivors had a lower length of stay (11 [6–13] vs 18 [13–23.5], p = 0.009). There was a weak albeit significant correlation between both NUTRIC and mNUTRIC score and LOS (R2 = 0.081, p = 0.039 and R2 = 0.074, p = 0.046, respectively).

4. Discussion

In our cohort of critically ill patients with COVID-19, we found that the discriminative ability of NUTRIC and mNUTRIC scores in predicting ICU mortality was lower than previously reported. In survivors, IL-6 levels were slightly but significantly lower than non survivors. Moreover, COVID-19 patients may have coexisting conditions such as diabetes mellitus, chronic lung diseases, cardiovascular diseases, obesity, and other diseases that make them relatively immunocompromised [8]. All these comorbidities may exacerbate and intensify the inflammatory response. Indeed, chronic inflammation overlaps to uncontrolled acute inflammation that, together with cytokine storm release, is thought to be responsible of multiple organ failure in patients affected from SARS-CoV-19 [9].

Therefore we would have expected some differences between the two scores based on highest IL-6 levels. However, in our cohort, IL-6 levels were lower than the cutoff proposed by Heyland of 400 ng/L.

Despite the severity at admission, in our cohort all patients had low nutritional risk according to NUTRIC and mNUTRIC scores. Other factors contributed in determining low risk, as the relatively young age, the absence of comorbidities and the short interval between hospital and ICU admission, which may explain the less satisfactory predictive ability of the scores as compared to the original studies.

Nevertheless, COVID-19 patients should be considered at risk for malnutrition because of specific symptoms of disease. In particular reduced food intake may be due to gastrointestinal disorders and changes in taste and smell. This underlines the importance of screening tools for defining malnutrition in this selected population.

In addition, Nutric and mNutric scores were assessed for their performance in terms of mortality in ICU and this may be the reason why their discriminative ability is lower than in the previous studies. Indeed, we considered ICU mortality as outcome while in original works the primary outcome was 28 days mortality.

In contrast, higher NUTRIC and mNUTRIC scores were significantly positively related to an increased length of ICU stay.

Regarding nutritional intake, our patients received early enteral nutrition; the nutritional targets, as suggested by guidelines, were nearly reached in almost all patients before the fifth day of stay, with 22 (16.4–23.4) kcal/kg and 1.1 (0.9–1.3) g/kg of proteins [10]. No differences were found between survivors and non survivors.

This study has several limitations: first of all the retrospective, single-centre design and the second, we investigated mortality in ICU as outcome while previous studies considered 28-day mortality; third, a small population of patients with COVID-19 was studied, and our findings may not be generalizable to other populations.

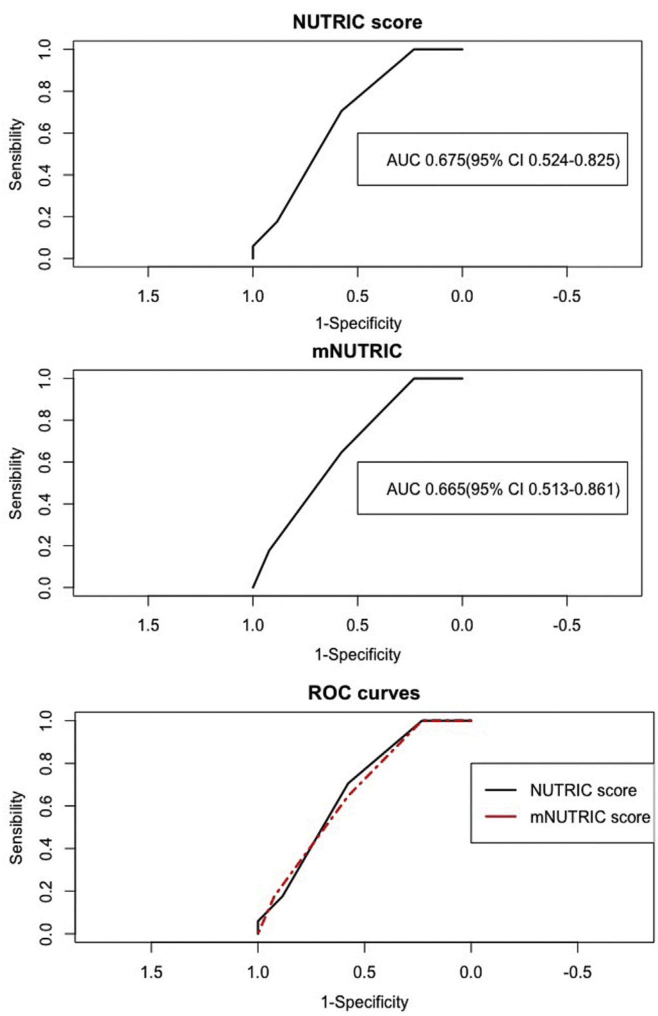

Fig. 1. ROC curves for NUTRIC score and modified NUTRIC score.

5. Conclusions

In this study, we found no difference between NUTRIC score and mNUTRIC score in predicting ICU mortality in critically ill patients with severe COVID-19 related ARDS, even in this specific population where inflammation seems to play a key role. The low discriminative ability of the two scores, and the classification of all of our patients as low nutritional risk calls for the development of further risk scores in this specific population.

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Conflict of interest

None.

References

[1] Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. Corrigendum to "world Health organization declares global emergency: a review of the 2019 novel coronavirus (COVID-19)". Int J Surg 2020;76(2020):71–6. https://doi.org/10.1016/j.ijsu.2020.03.036. International Journal of Surgery (London, England), 77, 217.

[2] Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet (London, England) 2020;395(10223):507–13. https://doi.org/10.1016/S0140-6736(20)30211-7.

[3] Cerra FB, Benitez MR, Blackburn GL, Irwin RS, Jeejeebhoy K, Katz DP, et al. Applied nutrition in ICU patients. A consensus statement of the American College of Chest Physicians. Chest 1997;111(3):769–78. https://doi.org/10.1378/chest.111.3.769.

[4] Singer P, Blaser AR, Berger MM, Alhazzani W, Calder PC, Casaer MP, et al. ESPEN guideline on clinical nutrition in the intensive care unit. Clin Nutr (Edinburgh, Scotland) 2019;38(1):48–79. https://doi.org/10.1016/j.clnu.2018.08.037.

[5] 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 (London, England) 2011;15(6):R268. https://doi.org/10.1186/cc10546.

[6] 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 (Edinburgh, Scotland) 2016;35(1):158–62. https://doi.org/10.1016/j.clnu.2015.01.015.

[7] Martindale R, Patel JJ, Taylor B, Arabi YM, Warren M, McClave SA. Nutrition therapy in critically ill patients with coronavirus disease 2019. JPEN. J Parenter Enteral Nutr 2020;44(7):1174–84. https://doi.org/10.1002/jpen.1930.

[8] Marazuela M, Giustina A, Puig-Domingo M. Endocrine and metabolic aspects of the COVID-19 pandemic. Rev Endocr Metab Disord 2020;21(4):495–507. https://doi.org/10.1007/s11154-020-09569-2.

[9] Li G, Fan Y, Lai Y, Han T, Li Z, Zhou P, et al. Coronavirus infections and immune responses. J Med Virol 2020;92(4):424–32. https://doi.org/10.1002/jmv.25685.

[10] Barazzoni R, Bischoff SC, Breda J, Wickramasinghe K, Krznaric Z, Nitzan D, et al. ESPEN expert statements and practical guidance for nutritional management of individuals with SARS-CoV-2 infection. Clin Nutr (Edinburgh, Scotland) 2020;39(6):1631–8. https://doi.org/10.1016/j.clnu.2020.03.022.