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ORIGINAL RESEARCH

A new simple score to predict mortality of COVID-19 in the emergency department

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Abstract

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic is one of the greatest challenges facing global medical research. The availability of a clinical score that can predict mortality risk at the time of diagnosis could be a valuable tool in the hands of emergency physicians to make clinical decisions. Our study is designed to evaluate clinical and laboratory endpoints associated with mortality and to determine a prognostic score based on clinical and laboratory variables. We retrospectively enrolled 367 patients diagnosed with coronavirus disease 19 (COVID-19) in our emergency department (ED). We evaluated their mortality 60 days after diagnosis. Symptoms, demographic data, concomitant diseases, and various laboratory parameters were obtained from all patients. Variables related to death were assessed using multiple logistic regression analysis. From these, we created a score called ANCOC (Age, blood urea Nitrogen, C-reactive protein, Oxygen saturation, Comorbidities). The area under the receiver operating characteristic (ROC) curve was calculated for the ANCOC and for the 4C score. The 4C score has been described and validated in previous works and can predict mortality in COVID-19 patients. We compared the 2 scores and analysed sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for 60-day mortality for the ANCOC score. The ANCOC and 4C scores accurately predicted death from COVID-19. There were no differences in accuracy between the scores. An ANCOC score <-1 identified patients who will recover with a PPV and sensitivity of 100%, whereas a score >3 identified patients at high risk of death. The ANCOC score has very high diagnostic accuracy in predicting the risk of death in patients with COVID-19 diagnosed at ED. The ANCOC score has similar accuracy to the 4C score but is easier to calculate. If validated by external cohorts, this score could be an additional tool in the hands of ED physicians to identify COVID-19 patients at high risk of death.

Keywords

COVID-19; Prognostic score; Comorbidity; SARS-CoV-2; Mortality

1. Background

COVID-19 represents the most important medical, scientific, and political challenge currently facing the entire world. Although highly effective vaccines are available to prevent infection and mitigate the severity of the disease [1–4], we are still far from conquering it. Patients with SARS-CoV-2 infection exhibit remarkable clinical variability, ranging from completely asymptomatic forms to severe clinical pictures with respiratory failure and high mortality. The availability of a clinical score that can help emergency physicians interpret the prognosis of patients with COVID-19 in daily practice could be a valuable tool to target available resources to the patients who need them most and to choose the type of therapeutic decision to be made at the time of diagnosis. Several scores have been proposed to assess COVID-19 prognosis. One of the most commonly used scores was the 4C mortality score [5]. It evaluates 8 variables (age, sex, concomitant diseases, respiratory rate, peripheral oxygen saturation, state of consciousness, urea level, and c-reactive protein) and has a range of 0 to 21 points. In the original study, it showed an accuracy of 0.79 in predicting mortality with better performance than other classic prognostic scores such as pneumonia severity index (PSI), confusion, uremia, respiratory rate, blood pressure, and age >65 years (CURB-65), sequential organ failure assessment (SOFA) and national early warning score (NEWS) [6]. The aim of this study is to evaluate the clinical and laboratory parameters associated with increased mortality in patients with SARS-CoV-2 infection, identify a score that can predict COVID-19 outcomes, and compare it with the 4C mortality score.

2. Methods

2.1 Study design

This is a monocentric, observational, and retrospective study.

2.2 Population

We enrolled 367 patients over 17 years of age who presented to the emergency department (ED) of Fondazione Policlinico Gemelli hospital in Rome in March 2020 with SARS-CoV-2 infection confirmed by real-time reverse transcription-polymerase chain reaction (RT-PCR) on oropharyngeal and nasopharyngeal swabs and who consented to data processing and study participation. We excluded patients with COVID-19 infection and other acute diseases affecting prognosis (diseases requiring urgent surgery, time-dependent diseases, acute diseases with the possibility of unfavorable outcome) and patients with chronic diseases with poor prognosis (<60 days).

Patients were divided into the following groups according to their outcome 60 days after admission to ED:

—recovered patients;

—deceased patients.

2.3 Data collection

We collected the following data for each patient:

—demographic data: age, gender, smoking habits, history of chronic disease, medication use, blood type, in-hospital treatment;

—symptoms: arthralgia/arthritis, asthenia, adenopathy/lymphadenitis, headache, myalgia, conjunctivitis, nausea, diarrhea, fever, dyspnea, cough, abdominal pain, rash, pharyngodinia/pharyngitis, vomiting, dys/ageusia, dys/anosmia, rhinorrhea, anorexia;

—laboratory data at ED visit: blood urea nitrogen (BUN), creatinine, sodium, potassium, alanine aminotransferase (ALT), bilirubin, lactate dehydrogenase (LDH), creatine phosphokinase (CPK), platelets, hemoglobin, leukocytes, neutrophils, lymphocytes, d-dimer, international normalized ratio (INR), fibrinogen, C-reactive protein (CRP), procalcitonin (PCT) and n-terminal pro brain natriuretic peptide (NTproBNP).

—in all patients, 60-day mortality data were collected from medical records and/or by telephone.

2.4 Aim of the study

The main objective of the study was to evaluate, in the group of COVID-19 patients, the presence of clinical symptoms and laboratory parameters associated with the outcome of the disease (60-days mortality), and to find a new clinical score that can predict death.

The secondary outcome was to compare the accuracy of this new score with the 4C mortality score in the prediction of mortality in COVID-19 patients.

2.5 Statistical analysis

The software used for statistical analysis is IBM SPSS Statistics for Windows, Version 16.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used for data analysis. Numerical values were expressed as % of total and continuous values were expressed as mean $\pm$ standard deviation (SD). Clinical symptoms and laboratory data were compared between groups using the chi-square test or the student *t*-test, where appropriate. Multivariate analysis (multiple logistic regression) was performed for those factors that showed a significance of $p < 0.01$ in the univariate analysis after adjustment for confounding factors such as sex, age, and comorbidities. A $p < 0.05$ was considered significant. The factors that remained significantly correlated with death at 60 days on multivariate analysis were included in a prognostic score for which sensitivity, specificity, positive predictive value (PPV), negative predictive valute (NPV), and the best cutoff value were calculated by constructing the receiver operating characteristic (ROC) curve. Based on the higher sensitivity or specificity cutoffs obtained for each significant variable in the multivariate analysis, we construct a prognostic score and evaluate a ROC curve and the area under the curve (AUC) for this score and for the 4C mortality score. Comparison of the area under the receiver operating characteristic (AUROC) curves was performed using the DeLong method.

3. Results

3.1 Characteristics of the patients

367 patients with a mean age of 62.9 $\pm$ 15.9 years were included in the study. 234 (63.7%) were men and 133 were women. 162 (58.7%) patients were nonsmokers, 91 (33.0%) were ex-smokers, and 23 (8.3%) were smokers and had a mean of 29.09 $\pm$ 29.52 lifetime packs/year. Patients differed in the presence or absence of comorbidities and their number. 127 patients (31.9%) had no comorbidities, 98 (26.7%) had 1 comorbidity, 51 (13.9%) had 2 comorbidities, 31 (8.4%) had 3 comorbidities, 23 (6.3%) had 4 comorbidities, and 8 (2.1%) had more than 4 comorbidities. 116 patients (31.6%) were taking angiotensin receptor blockers (ARBs) or angiotensin converting enzyme inhibitors (ACEi), whereas 232 (63.2%) were not. The most common comorbidities were hypertension, diabetes, ischemic heart disease, heart failure, atrial fibrillation, chronic obstructive pulmonary disease (COPD), chronic lung disease, obesity, active neoplasms, Parkinson's disease, Alzheimer's disease, and other chronic diseases (Table 1).

Other chronic conditions included thyroid disease (thyroiditis, hypothyroidism, hyperthyroidism), hypercholesterolemia, dyslipidemia, chronic renal failure, benign prostatic hyperplasia, depression, epilepsy, dementia, inactive cancers (colon cancer, breast cancer, lung cancer, leukemia), ulcerative colitis, and thrombocytopenia. Of the patients who came to the ED, 54 (14.7%) were discharged, 242 (66%) were admitted as inpatients and did not require intensive care unit (ICU) admission and 68 (19.3%) were admitted as inpatients and required at least one day in ICU. The mean duration of total hospitalization was 16.11 $\pm$ 15.48 days, while the duration of ICU admission was 3.03 $\pm$ 8.56 days. 56 (15.2%) patients were died at 60 days from ED visit.

We found rhinorrhea in 32 patients (8.7%), arthralgia/arthritis in 78 (21.2%), asthenia in 180 (49%),

TABLE 1. Prevalence of comorbidities in enrolled patients (number and percentage).

Comorbidity	Number (%)
Hypertension	156 (42.5)
Ischemic heart disease	46 (12.5)
Diabetes	42 (11.4)
Obesity	39 (10.6)
COPD	31 (8.4)
History of active neoplasia	25 (6.8)
Heart failure	22 (5.9)
Atrial fibrillation	17 (4.6)
Alzheimer's disease	11 (2.9)
Parkinson's disease	3 (0.8)
Other chronic diseases	103 (28.1)

COPD: chronic obstructive pulmonary disease.

lymphadenopathy in 2 (0.5%), headache in 59 (16.1%), myalgia in 73 (19.9%), conjunctivitis in 45 (12.3%), nausea in 53 (14.4%), fever in 334 (91%), dyspnea in 241 (65.7%), cough in 246 (67%), abdominal pain in 9 (2.4%), rash in 34 (9.3%), pharyngitis/throat pain in 44 (12%), vomiting in 26 (7.1%), dys/anosmia in 97 (26.4%), dys/old weakness in 106 (28.9%), anorexia in 113 (30.8%). Fever lasted an average of 8.8 ± 5.1 days, dry cough 10.2 ± 7.8 days, dys-/anosmia 16.1 ± 12.8 days, and dys-/ageusia, and anorexia 14.9 ± 12.2 days. A large percentage of patients, 33.2% (122), had other symptoms at baseline, including diarrhea, otorrhea, otalgia and dysuria.

Vital signs and laboratory values were obtained in each patient: systolic blood pressure, diastolic blood pressure, heart rate, respiratory rate, oxygen saturation, ratio of the partial pressure of oxygen in arterial blood to the inspired oxygen fraction (PaO_2/FiO_2), the partial pressure of CO_2 in arterial blood ($PaCO_2$), lactates, bicarbonate, chlorine, pH, blood urea nitrogen, creatinine, sodium, potassium, ALT,, total bilirubin, CPK, LDH, CRP, PCT, hemoglobin (Hb), platelets, leukocytes, neutrophils (absolute numbers and percentages), lymphocytes (absolute numbers and percentages), d-dimer, INR, fibrinogen, troponin, and NTproBNP (Table 2).

3.2 Univariate analysis

The prevalence and mean values of the parameters assessed were compared between deceased patients and those who recovered from COVID-19.

The mean age of cured patients was 60 ± 15.3 years, while that of deceased patients was 77.7 ± 9.4 years ($p < 0.0001$); 56.6% of patients who recovered had one or more comorbidities, while 29.4% of patients who died had one or more comorbidities ($p = 0.0013$). 71.2% of healed patients were taking ACEIs/ARBs versus 41.5% of deceased patients ($p = 0.00001$). Differences in signs and symptoms at presentation between groups were evaluated but were not statistically significant. In addition, major comorbidities were also compared: diabetes, hypertension, ischemic heart disease, heart failure, atrial fibrillation, COPD, obesity, history of active neoplasia, Parkinson's disease, Alzheimer's disease, and other chronic diseases. The prevalence of each of the comorbidities studied did not differ significantly between groups. Assessment of the patients' vital signs revealed differences between the two groups consistent compatible with the different clinical course of the disease (Table 2). Table 2 also describes the laboratory parameters. The parameters associated with an unfavorable outcome in the univariate analysis, with a $p < 0.01$ were: age, length of hospital stay, arthralgias, history of heart failure, atrial fibrillation, chronic lung disease, Alzheimer's disease, lactate, PaO_2, PaO_2/FiO_2 ratio, oxygen saturation, blood urea nitrogen, creatinine, potassium and CPK, LDH, CRP, PCT, neutrophils (both absolute and percentage) and lymphocytes percentage, d-dimer, fibrinogen, and NTproBNP.

3.3 Multivariate analysis

Multiple logistic regression analysis was performed including variables with a $p < 0.01$ in the univariate model and adjusting for age, sex, and number of comorbidities.

The following variables were found to be statistically significant:

—oxygen saturation ($p = 0.001$)
—CRP ($p = 0.03$)
—blood urea nitrogen ($p = 0.03$)
—comorbidity ($p = 0.01$)
—age ($p = 0.0001$)

The ROC curves were calculated for each of these variables and the area under the curve (AUC) was assessed. All AUCs were >0.7, indicating that these parameters have good accuracy as predictors of death (Fig. 1,2,3,4,5).

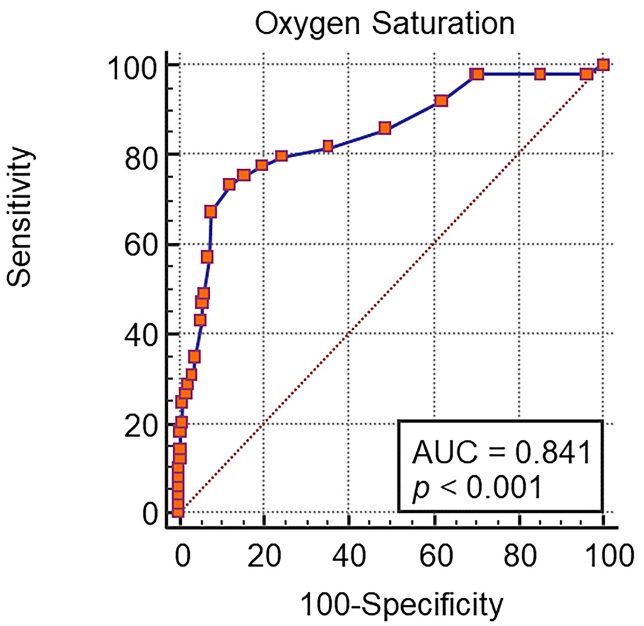

FIGURE 1. The area under the receiver operating characteristic (AUROC) curve analysis for Oxygen saturation as predictor of death at 60 days.

We then determined the cutoff values with the best sensibility and specificity for each parameter and assigned a score, as

TABLE 2. Clinical and laboratory parameters of all enrolled patients, patients who recovered from COVID-19 and patients who died up to 60 days after diagnosis. Comparison of parameters between the two groups studied. Data are expressed as mean ± standard deviation.

	Total	Recovered	Deceased	*p*
SBP (mmHg)	126 ± 27	127 ± 26	120 ± 34	ns
DBP (mmHg)	77 ± 15	78 ± 14	74 ± 22	ns
HR (bpm)	93 ± 18	94 ± 18	90 ± 21	ns
RR (breaths/min)	25 ± 9	25 ± 6	31 ± 11	ns
OS (%)	93 ± 7	95 ± 4	85 ± 10	<0.00001
PaO_2 (mmHg)	74 ± 24	75 ± 24	69 ± 22	0.09
PaO_2/FiO_2 (mmHg)	308 ± 106	313 ± 99	228 ± 100	<0.00001
$PaCO_2$ (mmHg)	34 ± 6	34 ± 5	33 ± 11	ns
Lactates (mmol/L)	1.9 ± 4	1.2 ± 1	4.5 ± 8	0.04
Bicarbonate (mmol/L)	23.7 ± 3	24 ± 3	22 ± 4	ns
Chlorine (mmol/L)	102 ± 10	101 ± 10	103 ± 6	ns
pH	7.4 ± 0.1	7.5 ± 0.1	7.4 ± 0.1	ns
BUN (mg/dL)	21 ± 16	18 ± 12	39 ± 23	<0.00001
Creatinine (mg/dL)	1.8 ± 7	1.8 ± 8	1.7 ± 1	ns
Sodium mmol/L	138 ± 5	138 ± 4	139 ± 9	ns
Potassium mmol/L	4.0 ± 0.5	4.0 ± 0.5	4.2 ± 0.6	0.005
ALT (U/L)	37 ± 42	35 ± 36	48 ± 67	ns
AST (U/L)	91 ± 71	53 ± 78	57 ± 45	ns
Bilirubin (mg/dL)	0.7 ± 0.4	0.7 ± 0.3	0.7 ± 0.4	ns
LDH (U/L)	358 ± 391	310 ± 132	618 ± 910	0.02
CPK (U/L)	203 ± 324	161 ± 206	428 ± 623	0.002
Hb (g/dL)	14 ± 2	14.1 ± 2	13.3 ± 3	0.02
Platelets (cells × 10^9/L)	204 ± 80	207 ± 78	196 ± 91	ns
Leukocytes (cells × 10^9/L)	8.1 ± 22	8.0 ± 22	8.7 ± 6	ns
Neutrophils (cells × 10^9/L)	5.2 ± 3	4.9 ± 3	6.7 ± 4	0.001
Neutrophils (%)	73.5 ± 13	72.2 ± 13	80.5 ± 24	<0.0001
Lymphocytes (cells × 10^9/L)	1.3 ± 2	1.2 ± 1.3	1.5 ± 4.0	ns
Lymphocytes (%)	19.1 ± 11	20.1 ± 10	13.6 ± 11	<0.01
d-dimer (ng/mL)	2634 ± 5252	2026 ± 4496	5203 ± 7180	<0.0001
Fibrinogen (mg/dL)	515 ± 172	501 ± 162	586 ± 204	0.004
CRP (mg/dL)	85 ± 84	70 ± 69	166 ± 104	<0.001
Procalcitonin (ng/dL)	0.8 ± 4.1	0.2 ± 1.2	3.2 ± 9.1	0.015
Troponin (mg/dL)	561 ± 518	363 ± 298	674 ± 611	ns
NT-proBNP (pg/mL)	1975 ± 5203	640 ± 1051	6267 ± 9414	<0.005

SBP: Systolic Blood pressure, DBP: diastolic blood pressure, HR: hearth rate, RR: respiratory rate, OS: oxygen saturation, BUN: blood urea nitrogen, ALT: alanine aminotransferase, AST: aspartate aminotransferase, LDH: lactate dehydrogenase, CPK: creatine phosphokinase, Hb: hemoglobin, CRP: c-reactive protein, NT-pro-BNP: n-terminal pro brain natriuretic peptide, ns: not significant, PaO_2: partial pressure of oxygen in arterial blood, FiO_2: inspired oxygen fraction , $PaCO_2$: the partial pressure of CO_2 in arterial blood.

shown in Table 3. We used the best cutoff values for sensibility and specificity to create a score we called ANCOC (age, blood urea nitrogen, comorbidities, oxygen saturation, C-reactive protein). The ANCOC score ranged from –6 to 6 (Table 3). Patients with normal values of BUN, oxygen saturation, CRP, a low number of comorbidities, and under 55 years of age have a lower score; in contrast, patients with high values of BUN and CRP, low oxygen saturation, older than 55 years and

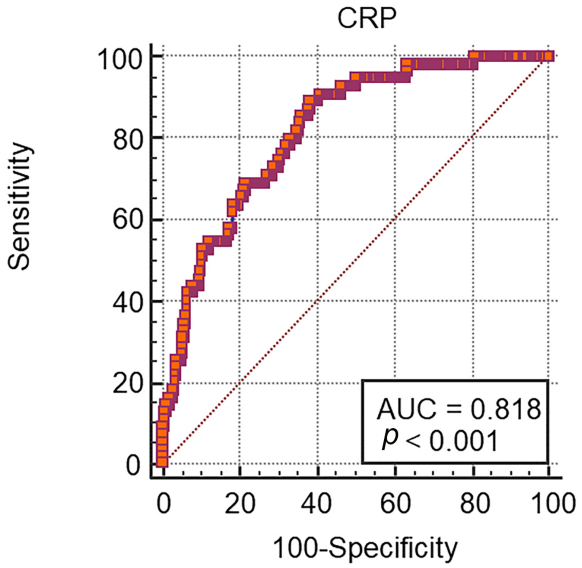

FIGURE 2. The area under the receiver operating characteristic (AUROC) curve analysis for c-reactive protein (CRP) as predictor of death at 60 days.

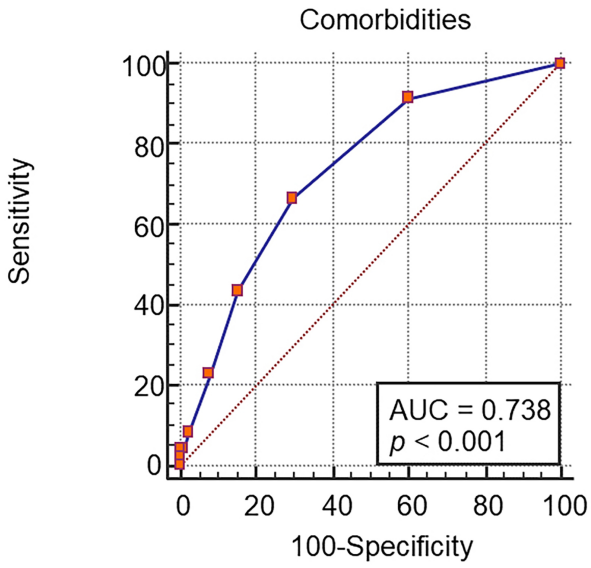

FIGURE 4. The area under the receiver operating characteristic (AUROC) curve analysis for number of comorbidities as predictor of death at 60 days.

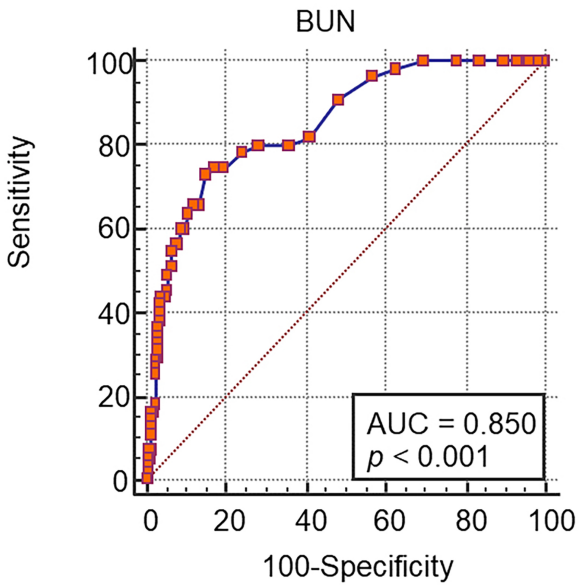

FIGURE 3. AUROC curve analysis for blood urea nitrogen (BUN) as predictor of death at 60 days.

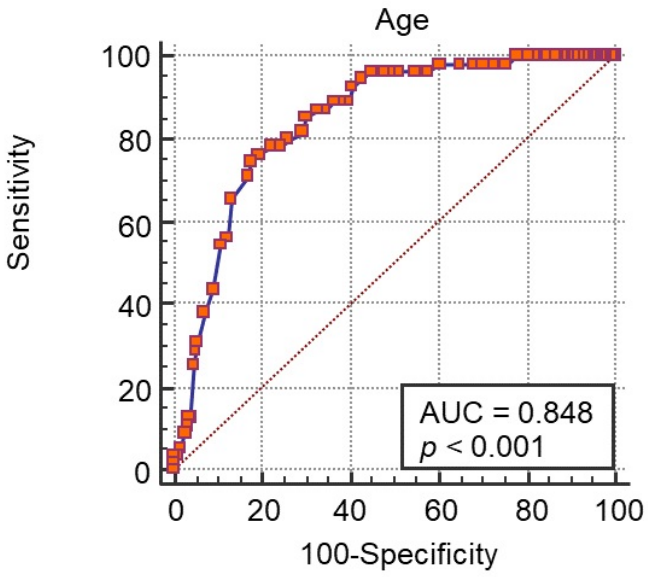

FIGURE 5. The area under the receiver operating characteristic (AUROC) curve analysis for age as predictor of death at 60 days.

with multiple comorbidities have higher ANCOC score. The 60-days mortality increases in relation to the ANCOC score. Mortality was zero for an ANCOC score lower than –1, 10% for –1, 25% for 0, 28% for 1, 35% for 2, 76% for 3, 86% for scores of 4 and 5, and 100% for 6 (Fig. 6)

We calculated the 4C mortality score for each patient and performed AUROC analysis for both the 4C mortality and ANCOC scores as predictors of 60-days mortality in COVID-19 patients (Fig. 7,8). No difference in accuracy in predicting death was found between the scores. At a value less than –1 the ANCOC score has a sensitivity of 100% and a PPV of 100% in identifying patients who will recover; in contrast, ANCOC values greater than 3 have a specificity of 98.5% and a PPV of 89.5% in identifying patients who will die.

4. Discussion

The occurrence of COVID-19 combined with the high risk of infection and significant morbidity and mortality has prompted the international scientific and medical community to make every effort to better understand and treat affected patients. The clinical presentation of COVID-19 is highly variable and similar to other diseases very common in the general population (colds, flu, pharyngitis, and pneumonia caused by other pathogens) [7]. The clinical course and prognosis also vary widely: it is estimated that about 80% of affected patients

TABLE 3. Best cutoff values of sensitivity and specificity of age, number of comorbidities, blood urea nitrogen, oxygen saturation, and C-reactive protein for mortality prediction.

Criterion	Sensitivity	95% CI	Specificity	95% CI	Score
BUN >35	43.6	30.3–57.7	96.37	93.6–98.2	1
BUN <15	96.4	87.5–99.6	43.23	37.6–49.0	−1
SO_2 >96	97.9	89.1–99.9	29.57	24.5–35.1	−1
SO_2 ≤88	48.9	34.4–63.7	94.02	90.7–96.4	1
ncom <2	91.6	80.0–97.7	39.86	34.1–45.8	−1
ncom >4	4.17	0.5–14.3	99.29	97.5–99.9	1
Age <55	98.2	90.3–100.0	39.48	34.0–45.2	−2
Age >80	43.6	30.3–57.7	90.94	87.2–93.9	2
CRP >26	94.5	84.9–98.9	36.75	31.3–42.5	−1
CRP >155	52.7	38.8–66.3	89.4	85.4–92.6	1

CI: confidence interval, BUN: blood urea nitrogen, SO_2: oxygen saturation, ncom: number of comorbidities, CRP: C-reactive protein.

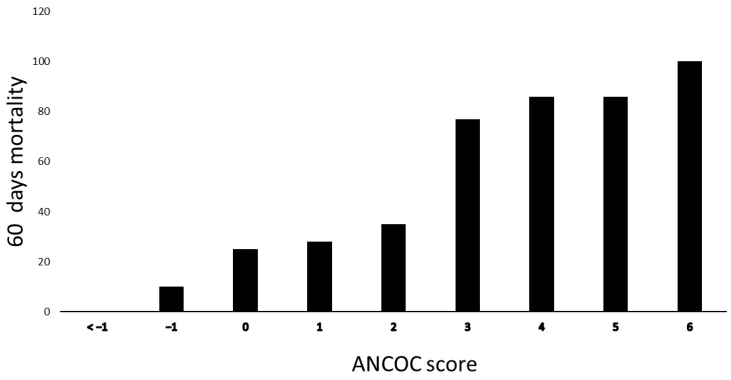

FIGURE 6. 60-days mortality for different ANCOC scores. ANCOC: (Age, blood urea Nitrogen, C-reactive protein, Oxygen saturation, Comorbidities).

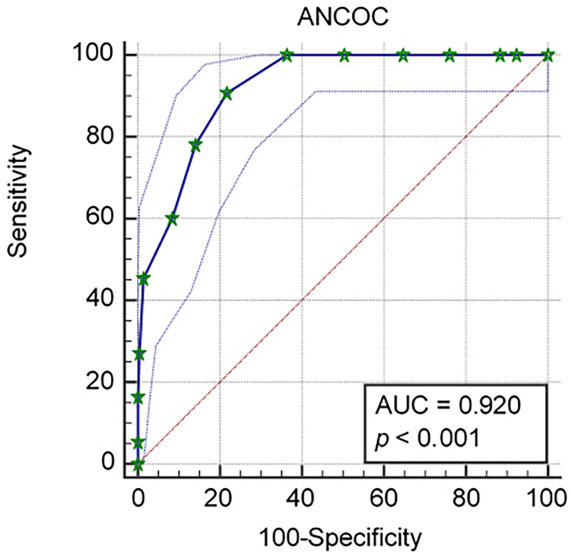

FIGURE 7. The area under the receiver operating characteristic (AUROC) curve analysis (solid blue) with 95% confidence interval (dashed curves) for ANCOC. (Age, blood urea Nitrogen, C-reactive protein, Oxygen saturation, Comorbidities) score as predictor of death at 60 days.

recover without requiring therapy and have only mild symptoms, while another 20% present with symptoms requiring hospitalization, and of these, 5–10% require treatment in the intensive care unit. Overall, the letality rate (which also varies strongly according to the geographical areas affected) is about 2% [8]. For this reason, based on the available data, the priority is to find the features of the COVID-19 associated with a more benign clinical course or, conversely, with severe complications such as pneumonia, acute respiratory distress syndrome (ARDS), and death. The introduction of vaccines has reduced the incidence and severity of the disease, but unfortunately, due to a variety of factors (diffusion not yet optimal to achieve herd immunity, the appearance of variants with higher transmissibility, reluctance to vaccinate, reduced ability to protect against infection over time), it has not yet been possible to contain the disease [9, 10]. There are new, more effective therapies, but their high cost may be an obstacle to their spread, particularly in developing countries [11]. A score that can predict the outcome of the disease could be very useful when resources are scarce. Therefore, we have defined a score that could guide the emergency physician and the intensivist in the management of the patient depending on specific clinical characteristics and laboratory parameters: the ANCOC score. A score above 3 means that the patient is likely to experience serious complications, including death, whereas a score below –1 means that the patient will recover. This score has high sensitivity, specificity, and PPV, making it a promising tool in the clinical management of patients with COVID-19. Other scores have been proposed to evaluate the severity and risk of death in COVID-19 patients. However, the validated scores only assessed in-hospital mortality. On the other hand, our score includes all-cause mortality (both inpatient and outpatient). We followed the patients that were discharged from the ED. This has proven to be very useful as

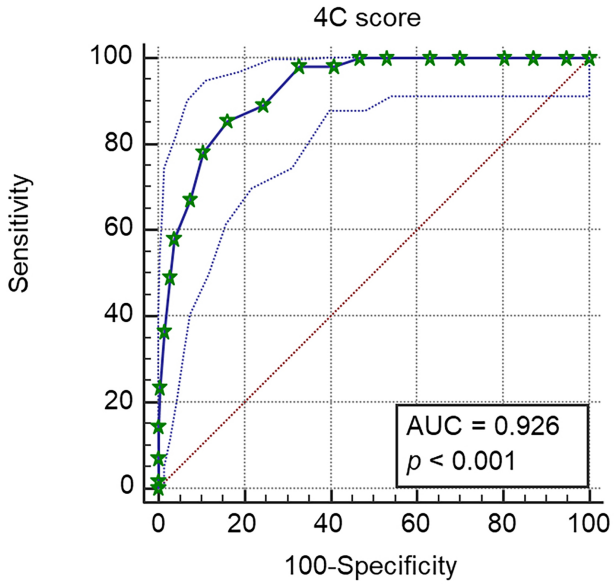

FIGURE 8. The area under the receiver operating characteristic (AUROC) curve analysis (solid blue) with 95% confidence interval (dashed curves) for 4C mortality score as predictor of death at 60 days.

8% of patients discharged from our ED deteriorated and were admitted to another hospital in our city up to 10 days after visiting our ED.

In addition, a recent study reviewed and validated 11 prognostic scores for COVID-19 [11]. The authors found that none of the evaluated scores had very high accuracy (AUC >0.80) in predicting in-hospital mortality and only 7 scores showed acceptable accuracy (AUC = 0.75–0.80) [6]. Interestingly, one of the most commonly used scores, the 4C mortality score, consists of eight variables (age, sex, number of concomitant diseases, respiratory rate, peripheral oxygen saturation, state of consciousness, blood urea nitrogen, and c-reactive protein) and includes the five variables used to calculate the ANCOC score [6]. However, the ANCOC score has similar excellent accuracy to the 4C score in predicting mortality at 60 days and is easier to calculate (because of the smaller number of variables required to generate it). It is important to clarify that we chose a follow-up period of 60 days to determine prognosis because 31 patients were still hospitalized 30 days after diagnosis (26 patients in an ordinary ward and 5 in an ICU).

Our study, however, has several limitations. First, it is a retrospective study with limitations related to its design. It is monocentric and was conducted during the first wave of the COVID-19 pandemic, making the results difficult to generalize. Moreover, data were collected when patients were admitted to the ED. This represents a selection bias, especially during the first wave of the pandemic, when the Italian government advised against going to ED unless particularly critical symptoms were present. In addition, models are also needed to account for other factors that could not be evaluated in this study (*e.g.*, antiviral therapies, emergence of new variants, and vaccination status) that could influence our prognostic score. Finally, the results of the study have not been validated. Because of the relatively small number of participants, internal validation was not possible. The ANCOC score needs to be validated by an independent external study before it can be used in a clinical context.

5. Summary

Our data, if confirmed and validated by external studies, suggest that the ANCOC score has similar accuracy to the 4C score in assessing COVID-19 mortality but evaluates fewer variables and could be an additional tool in the hands of emergency physicians to assess the prognosis of patients with COVID-19.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

MCa—designed the study, wrote original draft and edited; SC, MSF, MCo—wrote original draft; VO—reviewed, edited and corrected English; GP, AP, MG—reviewed and edited; ET—collected and analyzed data; AGu—performed statistical analysis and edited; AGa, FF, MA—supervised and reviewed; all authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the local ethic committee (Catholic University Ethic Committee), protocol number 0023001/20. Informed consent was obtained from all subjects involved in the study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. Marcello Candelli is serving as one of the Editorial Board members of this journal. We declare that Marcello Candelli had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to LV.

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