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Diagnostic accuracy of clinical gestalt of doctors with different experiences in COVID-19 suspected patients

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Abstract

This study aims to evaluate the ability of physicians' predictions to predict mortality in COVID-19 patients and compare physician predictions with scores developed for COVID-19 patients in predicting mortality and patient worsening. This study was conducted prospectively in the emergency department. Patient data were collected between 20.03.2021 and 20.06.2021. Patients who applied to our hospital with COVID-19 symptoms and were confirmed to be COVID-19 by rt-PCR results were included in our study. Patients aged 18 years and over who were tr-PCR positive were included in the study. Quick COVID-19 Severity Index (qCSI), Brescia-COVID Respiratory Severity Scale (BCRSS), and CURB-65 scale were calculated and recorded by a researcher. A total of 176 patients were included in our study. There was no significant relationship between physicians' gestalt and 28-day mortality (p=0.121, p=0.282, Mann-Whitney U Test, respectively). Physicians' gestalt was found to be insufficient to predict mortality in COVID-19 patients. There was a significant difference between the CURB-65 short-term mortality group and the survivors.

Keywords: COVID-19, gestalt, CURB-65, mortality

1. Introduction

The coronavirus disease COVID-19 started in Wuhan in December 2019. It spread rapidly around the world and was declared a pandemic. It causes severe acute respiratory syndrome in patients. Reverse transcription-polymerase chain reaction (RT-PCR) is used in the diagnosis of COVID-19 (1). The symptoms of the disease are very extensive. The most common symptoms are cough, shortness of breath, weakness, joint-muscle pain, and loss of smell and taste. Risk factors for the progression of the disease and death include old age, hypertension, diabetes, cardiovascular disease, lung disease, chronic kidney disease, malignancy, and immune system diseases (2). The mortality of the disease varies between 0.4% and 7%. It has been found that biomarkers associated with mortality were found to be a low amount of lymphocyte, high d-dimer, high C-reactive protein, high lactate dehydrogenase enzyme, and high interleukin-6 (3, 4).

In many countries, the number of COVID-19 patients exceeded the current health capacities of the countries in a short time. The high number of COVID-19 patients made it necessary to apply triage to these patients. Estimating the need for intensive care support or the need for a ventilator created a serious problem. Various scoring systems are used to predict the conditions such as hospitalization, need for ventilators, and mortality of COVID-19 patients (5). Quick COVID-19 Severity Index (qCSI), Brescia- COVID-19 Respiratory Severity Scale (BCRSS), and CURB-65 scale are some of them These scores are used in patient triages in many emergency departments (6). Until sufficient data on COVID-19 patients were published, all physicians decided to hospitalize or discharge patients with their own foresight. Physicians working in the emergency department used their experiences from lung infections and critical patients in the triage of COVID-19 patients. In this study, our aim is to evaluate the ability of physicians' predictions to predict mortality in COVID-19 patients and compare physician predictions with scores developed for COVID-19 patients in predicting mortality and patient worsening.

2. Materials and Methods

This study was conducted prospectively in the emergency department of Ümraniye Training and Research Hospital. Patient data were collected between March 20, 2021 and June 20, 2021. Approval was obtained from the local Ethics

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Committee. Our hospital worked as a tertiary pandemic hospital from 2020 to 2021. There were COVID-19 patients in all of the hospital wards and intensive care units during the study period. Patients who applied to our hospital with COVID-19 symptoms and were confirmed to be COVID-19 by rt-PCR results were included in our study. Patients aged 18 years and over who were rt-PCR positive were included in the study. Outpatients, patients who refused to participate in the study, and patients whose data could not be reached in the national death notification system were excluded from the study. Data in the study were obtained from three sources: the study form, the hospital computer-based data system, and the national death notification system. After the physical examination, the form for the same patient was filled out by two different physicians. The study form included age, gender, vital parameters, comorbidities and physician gestalt.

Vital parameters were recorded as saturation, pulse rate, systolic and diastolic blood pressure, state of consciousness, fever, respiratory rate, and oxygen support. Comorbidities were recorded as chronic obstructive pulmonary diseases, hypertension, diabetes mellitus, congestive heart failure, chronic kidney disease, active malignancy, cerebrovascular disease, and coronary artery disease. Laboratory parameters at admission and 28-day mortality information were recorded from the hospital information system. Blood urea nitrogen and C-reactive protein were recorded from laboratory parameters.

Brescia- COVID-19, qCSI, BCRSS, and CURB-65 scales were calculated and recorded by a researcher (A. Ö.) from the hospital's computerized information system. For the calculation of BCRSS, parameters such as wheezing or inability to speak comprehensively inability to form sentences with minimum effort while resting, respiratory rate >22, oxygen saturation (SpO_2) <90%, and deterioration in lung imaging were used. Patients were then classified into five risk levels by BCRSS. Nasal cannula flow rate, respiratory rate, and minimum fingertip oxygen level parameters were used to calculate qCSI. Parameters of confusion, blood urea nitrogen >19 mg/dl, respiratory rate, systolic blood pressure 90 mmHg or diastolic blood pressure below 60 mmHg, and age over 65 were used to calculate CURB-65. The primary outcome of our study was 28-day mortality. Data were analyzed using Jamovi (Version 1.6.21.0; The Jamovi Project, 2020; R Core Team, 2019). Categorical variables were expressed as a percentage. It has been calculated as the median (interquartile range (IQR)) for continuous variables. The patients were grouped as survivor and non-survivor. The relationship between clinicians' gestalt and mortality was evaluated. Variables that did not fit the normal distribution were compared using the Mann-Whitney U test. The receiver operating characteristic (ROC) curve was used to determine the accuracy of the regression model in predicting short-term mortality. The area under the curve (AUC) and a 95% CI were calculated for the short-term mortality prediction of the gestalt. A p-value less than 0.05 was considered statistically significant.

3. Results

Between March 20, 2021 and June 20, 2021, 393 patients applied to the emergency department of our hospital due to COVID-19. Two hundred seventeen of those were excluded from the study (Fig. 1.). A total of 176 patients were included in our study. The median (25th-75th percentile) age was 8.5 (48-68) years, and 51.1% of the patients were female. The mortality rate in our study was 15.9%. The most common comorbidity was hypertension 71 (40.3%). According to their frequency, other comorbidities are diabetes mellitus 45 (25.6%). Congestive heart failure is 13 (7.4%). Coronary artery disease is 12 (6.8%). Baseline characteristics of the enrolled patients and a comparison of the characteristics between the survivor and non-survivor groups are shown in Table 1. The 28-day mortality values of the other scores in which the physician's predictions were compared are given in Table 2. AUC values were calculated to measure how different scores predicted mortality. The AUC value for qCSI was 0.567, 0.503 for BCRSS, and 0.656 for CURB-65 Score (p=0.210, p= 0.966, p=0.004, respectively) (Table 3). ROC curves for the scores are shown in Fig. 2. There was no significant relationship between physicians' gestalt and 28-day mortality (p=0.121, p=0.282, Mann-Whitney U Test, respectively).

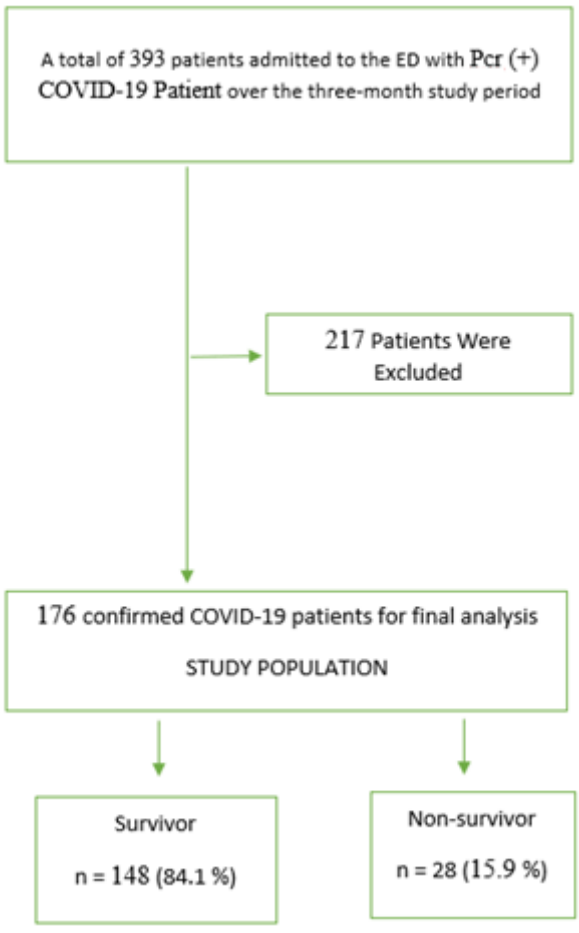

Fig. 1. A flow diagram of the study population

Table 1. Baseline characteristics of the enrolled patients and comparison of the characteristics between the survivor and non-survivor groups

Variables	Total	Survivor	Non-survivor	p values
	n=176 (%, 25th –75th percentiles)	**n=148** (%, 25th – 75th percentiles)	**n=28** (%,25th – 75th percentiles)	
Age, years	58.5 (48-68)	57.5 (47-67.3)	63.7 (51.0-71.8)	0.094
Gender				
Male	86 (48.9%)	72 (48.6%)	18 (64.3%)	
Female	90 (51.1%)	76 (51.14%)	10 (35.7%)	
Comorbidities (%)				
Chronic obstructive pulmonary diseases	6 (3.4%)	4 (2.7%)	2 (7.1%)	0.239
Hypertension	71 (40.3%)	61 (41.2%)	10 (35.7%)	0.589
Diabetes mellitus	45 (25.6%)	42 (28.4%)	3 (10.7%)	**0.050**
Congestive heart failure	13 (7.4%)	10 (6.7%)	3 (10.7%)	0.467
Chronic kidney disease	6 (3.4%)	3 (2%)	3 (10.7%)	**0.021**
Active malignancy	2 (1.1%)	2 (1.4%)	0 (0%)	0.545
Cerebrovascular disease	6 (3.4%)	6 (4.0%)	0 (0%)	0.079
Coronary artery disease	12 (6.8%)	12(8.1%)	0 (0%)	0.945
Comorbidity	109 (61.9%)	90(60%)	19 (67.8%)	0.484
Vital parameters				
Systolic blood pressure	128 (114-140)	128 (114-140)	132(118-144)	0.270
Diastolic blood pressure	76.5 (69.0-84.0)	76.3 (69.0-84.0)	77.2 (69.8-84.5)	0.453
Pulse pressure	90 (79.0-100)	89.2 (78.0-100)	94.2 (82.0-104)	0.106
Respiratory rate	21.9 (18.0-25.0)	21.6 (18.0-24.0)	23.8(18.8-28.5)	0.068
Oxygen saturation	88.0 (86-93)	89.2 (87.0-93.0)	86.3 (83.0-93.3)	0.535
Oxygen supplement	3.40 (2-4)	3.11 (2-4)	4.89 (2-6.5)	0.086
Lactate	1.62 (1.20-1.98)	1.68 (1.20-2.0)	1.38 (1.00-1.60)	0.132
Blood urea nitrogen	37.6 (23.0-45.0)	36.1 (23.0-42.0)	45.3 (29.5-53.3)	**0.011**
C-Reactive Protein (mg/L)	94.3 (45.8-131)	93.5 (45.8-133)	98.6 (46.3-121)	0.921

Table 2. comparison of the scores between the survivor and non-survivor groups.

		n (%)	Survivor	Non-survivor	p
CURB-65	**0**	1 (0.6 %)	1	0	0.003
	1	25 (14.2 %)	24	1	
	2	104 (59.1 %)	90	14	
	3	38 (21.6 %)	28	10	
	4	8 (4.5 %)	5	3	
BCRSS	**0**	31 (17.6 %)	25	6	0.955
	1	64 (36.4 %)	55	9	
	2	48 (27.3 %)	41	7	
	3	33 (18.8 %)	27	6	
qCSI	**1**	81 (46.0 %)	71	10	0.232
	2	21 (11.9 %)	17	4	
	3	30 (17.0 %)	25	5	
	4	44 (25.0 %)	35	9	

Table 3. Sensitivity, specificity, positive predictive value, negative predictive value, and likelihood ratio for different CURB-65, qCSI and BCRSS scores for predicting death

	Cut point	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	AUC	LR		p
qCSI	1	100%	0%	15.91%	NaN%	0.567	1	1-1	0.381
	2	64.29%	47.97%	18.95%	87.65%		1.24	0.9- 1.7	
	3	50%	59.46%	18.92%	86.27%		1.23	0.81- 1.87	
	4	32.14%	76.35%	20.45%	85.61%		1.36	0.74- 2.51	
BCRSS	1	100%	0%	15.91%	NaN%	0.503	1	1-1	0.733
	2	78.57%	16.89%	15.17%	80.65%		0.95	0.77- 1.17	
	3	46.43%	54.05%	16.05%	84.21%		1.01	0.65- 1.56	
	4	21.43%	81.76%	18.18%	84.62%		1.17	0.53- 2.57	
CURB-65	1	100%	0%	15.91%	NaN%	0.656	1	1-1	0.014
	2	100%	0.68%	16%	100%		1.01	1- 1.02	
	3	96.43%	16.89%	18%	96.15%		1.16	1.05- 1.28	
	4	46.43%	77.7%	28.26%	88.46%		3.17	0.8- 12.51	
	5	10.71%	96.62%	37.5%	85.12%		2.08	1.26- 3.43	

AUC: area under the curve; PPV: positive predictive value; NPV: negative predictive value; LR: likelihood ratio.

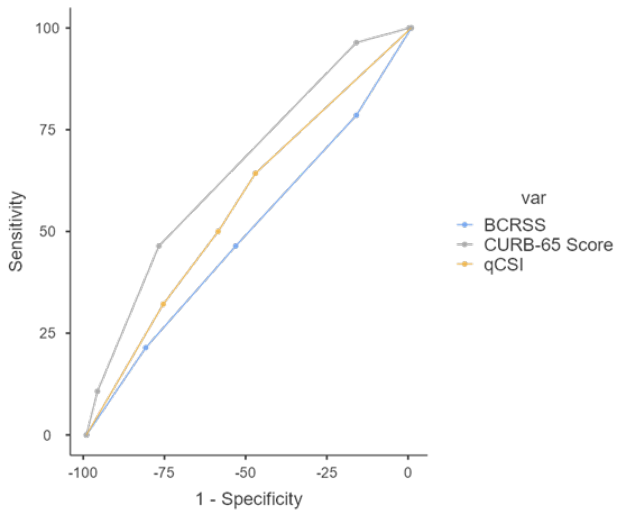

Fig. 2. ROC curves for mortality for the CURB-65, qCSI and BCRSS

4. Discussion

In our study, the role of emergency physicians' gestalt in predicting mortality in COVID-19 patients was investigated. Physicians' gestalt was found to be insufficient to predict mortality in COVID-19 patients. Moreover, when the compatibility of physicians with different experiences was evaluated, a statistically significant agreement was observed among physicians. (Kendall's Tau B: 0.617 p: 0.001). To the best of our knowledge, our study is the first to evaluate the compliance of physicians' gestalts in patients with COVID-19.

Clinical gestalt means that clinicians are capable of making clinical decisions indirectly in the absence of complete information and are able to generate solutions characterized by generalizations that allow transfer from one problem to another. In other words, clinical gestalt is pattern recognition and a heuristic approach to decision making (7). Various clinical scenarios have been studied on the gestalt of clinicians (8). In the COVID-19 pandemic, clinicians had to make vital decisions, given the burden on the healthcare system, especially in the early stages of the disease (9). Many clinicians have had to manage clinical condition of COVID-19 patients they have not encountered before. Soto-Mota et al. evaluated clinicians' gestalts in clinical scenarios in the management of the disease in their study during the first peak period. They found the diagnostic value of gestalt to be 0.680, a value that could be reported as insufficient (10). In our study, similar to the study of Sota-Mota et al., we found the gestalt to be insufficient in predicting mortality. A plausible explanation for this may be that the COVID-19 Disease does not resemble the course of pneumonia clinicians previously knew. Mortality in COVID-19 occurs in three ways. These are cytokine storms thromboembolic processes, and respiratory failure caused by viral pneumonia. These processes may follow clinical courses contrary to the previous experience of clinics with viral pneumonia. These new pathogeneses may have caused gestalt insufficiency. There was agreement between the different clinician gestalts, confirming this explanation.

The disease, which spread rapidly during the pandemic, caused an overload in the health system. Identifying patients in need of medical support was essential to use health capacity effectively (11). Bradley et al. reported in their study that CURB-65 can predict short-term mortality of COVID-19 (12). Akça et al. investigated the relationship between PSI, CURB-65, CALL and BCRSS and short-term mortality in their study. They showed that there was a significant difference in scores between the mortality group and the survivors (13). In our study, there was a significant difference between the CURB-65 short-term mortality group and the survivors.

Results of this study showed that the qCSI could not be a predictor of mortality in COVID-19 (AUC 0.567, p:0.232). Covino et al. found qCSI to have the highest PPV in predicting hospital mortality (14). However, this AUC could not rise above the strong correlation of 0.8 (AUC: 0.749) (15). According to results of current study, BCRSS is a scale used to determine the respiratory severity of COVID-19 pneumonia, showing the patient's need for oxygen and mechanical ventilation. While providing information about the clinical course of the patients, it could not predict mortality (p 0.955). This may be the reason why qCSI, BCRSS, and clinician gestalt fail to predict mortality. The disease has a mild infection phase, pulmonary involvement phase, and cytokine storm phase (16). The vast majority of patients admitted to the hospital are in the stage of pulmonary involvement. These scorings cannot predict the cytokine storm that is thought to cause the death of COVID-19 patients. The cytokine storm is generally blamed for mortality during intensive care or service admission. There is no suggestion or scoring system that will help us understand when the cytokine storm will start and its severity (17). None of the scores we evaluated can predict the cytokine storm (18). Other reasons why the scoring done in the emergency department could not predict mortality may be: Arterial and venous thrombotic conditions which are causes of mortality and morbidity, formation of disseminated intravascular coagulopathy, long-term hospitalization, admission to the intensive care unit, and the necessity for mechanical ventilation's being after hospital admission (19). Scorings made in the emergency services are made at the time of application. Therefore, the inability to predict mortality can be attributed to these reasons. We think that more research is needed on this subject.

Our study had several limitations. Firstly, vaccine applications had just started in our country at the time of our study. Therefore, it can be said that our study cohort was unvaccinated. Considering that vaccination programs have become widespread throughout the world, we believe that the generalizability of our study to the vaccinated population is limited. Secondly, although agreement between clinicians was

observed in our study, our study was conducted with emergency specialists. We believe that its generalizability to other specialists may be limited. Finally, the fact that our study was single-centered is another factor that will affect its generalizability. We recommend that our results be validated with multicenter studies involving other specialists.

In conclusion, according to the results of our current study, the clinical gestalt of emergency medicine specialists is not sufficient to predict short-term mortality in COVID-19 patients. We recommend that clinicians use scoring systems such as CURB-65 instead of gestalt when making clinical decisions regarding COVID-19 patients. Evaluation of different scoring systems in patients hospitalized for COVID-19 can be cited as one of the strengths of this study.

Conflict of interest

We declare no conflict of interest.

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None to declare.

Authors' contributions

Concept: A. Ö., Design: A. Ö., Data Collection or Processing: A. Ö., Analysis or Interpretation: A. Ö, Literature Search: A. Ö, Writing: A. Ö.

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