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Evaluation of the factors predicting the need for intensive care of patients with COVID-19 aged above 65 years: data from an emergency department in Turkey

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SUMMARY

OBJECTIVE: Individuals aged ≥65 years are more susceptible to COVID-19 disease and admission to intensive care is most notable. The scoring systems (national early warning score, quick sequential organ failure assessment, shock index) are recommended for rapid assessment of patients in emergency room conditions. The goal of our study is to evaluate scoring systems in conjunction with predictive factors of need for admission to intensive care of patients ≥65 years old with a diagnosis of COVID-19 who applied to the emergency room.

METHODS: Patients were divided into two groups according to evolution in the emergency room, being those who needed or not intensive care. National Early Warning Score, quick sequential organ failure assessment, shock index scores and serum biochemistry, blood count and blood gas values were evaluated from hospital information management system records.

RESULTS: Of the patients included in the study, 80.8% were admitted to the ward and 14.5% to the unit of intensive care. Lymphocyte count, base deficit and bicarbonate levels were lower, and the levels of C-reactive protein, lactate, D-dimer, urea and lactate dehydrogenase were higher in patients who needed intensive care. Quick sequential organ failure assessment and shock index were considered significant in the group admitted to the intensive care unit.

CONCLUSIONS: We recommend that quick sequential organ failure assessment and shock index be used quickly, practically and easily in predicting the need for intensive care unit in patients aged ≥65 years in emergency department diagnosed with COVID-19.

KEYWORDS: Age factors. Emergency medical services. Intensive care units.

INTRODUCTION

Coronavirus-19 (COVID-19) disease is an infectious disease caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2)[1,2]. Studies show that individuals aged ≥65 years are more susceptible to COVID-19 disease and have higher rates of hospital, intensive care, intubation, postintubation complications, and death[3-6]. Regarding the comorbid diseases, weak immune system also plays a role in increasing the sensitivity[7,8]. COVID-19, which develops with atypical symptoms, progresses to multiorgan failure within this age group[9]. It is noteworthy that admissions to the intensive care unit (ICU) are often the patients aged above 65 years[10]. A number of scoring systems have been developed to rapidly evaluate the patients with COVID-19 admitted to the emergency department. It has

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been stated that the National Early Warning Score (NEWS) in patients who are admitted to emergency department can reveal accurate results in both mortality within the hospital and hospitalization of patients from the emergency department to the ICU[11]. Quick Sequential Organ Failure Assessment (q-SOFA) is recommended as it provides a rapid prognosis to emergency department and critical care doctors and helps predict mortality[12]. The shock index (SI) can be used to predict mortality and the need for intensive care[13]. This study aims to determine the factors that predict the hospitalization of patients who aged above 65 years and diagnosed with COVID-19 in the emergency department and to evaluate those factors using the abovementioned scoring and indices.

METHODS

Study design

The study was planned retrospectively and was started after the approval of the ethics committee (dated: February 5, 2021, No. 2021-01). The patients with a diagnosis of COVID-19 who were hospitalized to the emergency department of the university hospital between June 2020 and February 2021 were included in this study. Demographic findings, vital signs, serum biochemistry, hemogram, and blood gas values of the patients were analyzed. The NEWS, q-SOFA score, and SI were used to assess the severity of patient with COVID-19. The patients were divided into two groups, namely, patients who need intensive care and those who do not, according to the outcome of the emergency department.

Patients

The patients with positive polymerase chain reaction, aged above 65 years, and diagnosed with COVID-19 were included in this study. The patients aged above 65 years, trauma patients, the patients who were not diagnosed with COVID-19, and whose information could not be obtained from the system were excluded from the study.

Laboratory analysis

Serum biochemistry analyses were performed using colorimetric method in the 501 module of the Roche Cobas 6000 device, the hemogram analyses with the electrical impedance method in the Beckman Coulter DXH 800 device, and the blood gas values were examined using ISE (ion-selective electrode) potentiometric method in the radiometer ABL 800 device.

Statistical analysis

Mann–Whitney U test was used for numerical variables and chi-square test for comparison of categorical variables. Logistic regression analysis was applied to predict ICU admission. A base model was created using the data with statistical significance in the multivariable analysis. The DeLong test was used for a pairwise comparison of the area under the curves[14]. SPSS version 26.0 was used for statistical analysis.

RESULTS

A total of 400 patients aged above 65 years and diagnosed with COVID-19 were included in the study. The mean age was 73 (interquartile range [IQR]: 68.0–80.75), and 229 (57.3%) patients were males. Demographic, laboratory parameters, and other characteristics of the patients are indicated in Table 1.

Comparing the groups with and without ICU hospitalization in terms of gender and the emergency department outcome, the NEWS was not significantly different between the two groups (p=0.630), while q-SOFA and SI were found to be significantly higher in the ICU group than the non-ICU groups (p<0.001), as given in Table 2.

The relationship between risk factors and mortality in patients with COVID-19 is given in Table 3.

DISCUSSION

In a study by Lee et al.[15] in patients aged above 65 years with a diagnosis of COVID-19, the median age was 72 and the majority were females[15]. Jin et al.[16] and Jansen et al.[17] showed that elderly males are more affected by COVID-19 infection than females. Elderly male gender is more prone to COVID-19 disease[18]. The mean age (73 years) and the predominance of male gender in our study correlate with the literature. The most common comorbid diseases in the elderly are hypertension (HT), cardiovascular diseases, diabetes mellitus (DM), chronic obstructive pulmonary disease, and hyperlipidemia[19]. In our study, HT and DM were found to be underlying comorbid diseases. Most common drugs related to these diseases used by the patients are antiplatelet and angiotensin-converting enzyme (ACE) inhibitors. HT is the most common comorbid disease diagnosed among the elderly patients. It was found that the use of drugs affecting the renin–angiotensin–aldosterone (RAS) system, due to the ability of COVID-19 disease to enter the host cell by binding to ACE-2, increases the sensitivity to COVID-19 and causes viral replication[20,21]. In our study, the hospitalization rate of the patients aged above 65 years and diagnosed with COVID-19 was high. This finding is in line with many other studies in the literature[3-6]. Only 3.5% of the patients were discharged from the emergency department. It was found that the more severe the COVID-19, the higher is the mortality and the need for intensive care in the elderly patients[4]. In China and Italy, most mortality cases are with the patients aged above

Table 1. Demographic parameters for study population.

	All patients (n=400)
Age	73.0 (68.0–80.75)
Sex/male, n (%)	229 (57.3)
Vital signs at triage	
Heart rate (beat/min)	87.0 (77.0–99.0)
Respiratory rate	22.0 (18.0–24.0)
SBP (mm Hg)	130.5 (115.0–147.0)
DBP (mm Hg)	78.0 (68.0–98.0)
SO_2 (%)	95.0 (90.0–98.0)
Chronic diseases, n (%)	
HT	258 (64.5)
DM	115 (28.8)
COPD	73(18.3)
CAD	78 (19.5)
Stroke	36 (9.0)
Cancer	28 (7.0)
CHF	33 (8.3)
CRD	20 (5.0)
Drug use, n (%)	
Antiplatelet	102 (25.5)
ACE inhibitors	92 (23.0)
Oral anticoagulants	81 (20.3)
Laboratory parameters	
Lymphocyte	1.0 (0.6–1.6)
C-reactive protein	7.68 (3.36–15.67)
D-Dimer	474.5 (279.25–940.75)
aPTT	29.0 (25.9–32.0)
INR	1.12 (1.03–1.24)
ALT	19.0 (12.0–29.97)
AST	28.6 (19.75–42.78)
Urea	49.6 (35.62–78.03)
Creatinine	1.07 (0.82–1.54)
LDH	326.0 (245.25–457.0)
Base deficit	-0.1 (-2.6, 2.3)
Bicarbonate	24.2 (22.3–26.1)
Shock index	0.67 (0.57–0.78)
NEWS≥10 (%)	71 (17.8)
q-SOFA≥2 (%)	61 (15.3)
Disposition, n (%)	
Discharge	14 (3.5)
Regular ward	323 (80.8)
ICU	58 (14.5)
Exitus in the ED	5 (1.25)
14-Day mortality	79 (19.8)
30-Day mortality	114 (28.5)

SBP: systolic blood pressure; DBP: diastolic blood pressure; HT: hypertension; DM: diabetes mellitus; COPD: chronic obstructive pulmonary disease; CAD: coronary artery disease; CHF: congestive heart failure; CRD: chronic respiratory disease; ACE: angiotensin-converting enzyme; aPTT: activated partial thromboplastin time; INR: international normalized ratio; ALT: alanine transaminase; AST: aspartate aminotransferase; LDH: lactate dehydrogenase; NEWS: national early warning score; q-SOFA: quick sequential organ failure assessment; ICU: intensive care unit; ED: emergency department.

60 years. Age plays a key role in the estimation of mortality[15,22]. It is suggested that old age is a risk factor for in-hospital deaths, is more sensitive to COVID-19 disease, and can have severe courses[9]. Comparing the 14- and 30-day mortality rates, this study found that mortality increases with an increase in the length of stay in the ICU. Studies also reveal that staying in the ICU with respiratory support for a long time increases mortality[20]. Ji et al.[23] stated that the number of ICU admissions were higher in the males aged above 65 years with an underlying comorbid disease[23]. In our study, there was no difference in terms of gender and the presence and number of comorbid diseases between patients who were admitted to the ICU and those who were not.

Vital signs play a key role in the early evaluation of patients diagnosed with COVID-19 and determination of whether the patients are at risk and require ICU admission[24]. In a study conducted on 2566 patients with an average age of 63, Hao et al.[25] found that there was no difference in respiratory rate, heart rate, and mean arterial pressure between the patients hospitalized in the ICU and those who were not[25]. In our study, systolic blood pressure, low oxygen saturation, and increased heart rate were found to be significant in terms of hospitalization in the ICU. Huang et al.[10] and Wang et al.[26] reported that dyspnea symptoms were more common in the patients admitted to ICU than in nonadmitted patients; the finding that is in line with our results. Liu et al. stated that in the patients aged above 60 years with COVID-19, the lymphocyte ratio was low and the C-reactive protein (CRP) level was high. Laboratory findings of elderly patients with COVID-19 also showed lymphopenia and high levels of CRP, lactate dehydrogenase (LDH),

Table 2. Demographic findings.

	Other, n=342	ICU admission, n=58	p-value
Age	73.0 (68.0–80.0)	75 (69.0–81)	
Sex: M/F, n (%)	195 (85.2)/147 (86.0)	34 (14.8)/24 (14.0)	0.819
Triage parameter			
SBP	132.0 (118.0–147.25)	116.5 (95.75–145.5)	0.002
DBP	78.0 (69.0–87.0)	74.0 (64.0–85.75)	0.136
Heart rate	86.0 (77.0–98.0)	99.5 (84.25–123.5)	<0.001
Respiratory rate	22.0 (18.0–24.0)	22.0 (18.0–26.0)	0.396
Oxygen saturation	95.0 (91.0–98.0)	90.5 (81.5–97.25)	0.004
Chronic disease, n (%)			
None	35 (77.8)	10 (22.2)	0.161
1	102 (89.5)	12 (10.5)	
2 and above	205 (85.1)	36 (14.9)	
Mortality status, n (%)			
Yes (n=127)	87 (68.5)	40 (31.5)	<0.001
No (n=273)	255 (93.4)	18 (6.6)	
Complaints at the ED admission, n (%)			
Fever (±)	239 (83.9)/103 (89.6)	46 (16.1)/12 (10.4)	0.142
Cough (±)	217 (81.3)/125 (94.0)	50 (18.7)/8 (6)	0.001
Dyspnea (±)	161 (95.8)/181 (78.0)	7 (4.2)/51 (22.0)	<0.001
Headache (±)	323 (85.0)/19 (95.0)	57 (15.0)/1 (5.0)	0.216
Fatigue (±)	276 (83.6)/66 (94.3)	54 (16.4)/4 (5.7)	0.022
Anosmia (±)	331 (86.2)/11 (68.8)	53 (13.8)/5 (31.3)	0.052
Diarrhea (±)	325 (84.9)/17 (100)	58 (15.1)/0 (0.0)	0.149
Joint pain (±)	300 (84.3)/42 (95.5)	56 (15.7)/2 (4.5)	0.066
Laboratory parameter			
Lymphocyte	1.0 (0.7–1.6)	0.67 (0.41–1.46)	0.008
CRP	7.32 (3.2–14.73)	8.69 (4.15–21.08)	0.021
Base deficit	0.1 (-2.3, 2.43)	-1.6 (-8.95, 1.5)	0.002
Lactate	1.6 (1.14–2.23)	2.25 (1.47–2.97)	<0.001
Bicarbonate	24.4 (22.8–26.2)	21.55 (16.5–25.4)	<0.001
D-Dimer	433.0 (276.0–778.0)	982.0 (439.0–2838.0)	<0.001
Urea	48.55 (35.2–72.0)	69.4 (42.3–117.4)	<0.001
Creatinine	1.03 (0.82–1.49)	1.25 (0.83–1.83)	0.098
LDH	324.5 (243.0–433.0)	374.5 (255.0–586.0)	0.018
NEWS, n (%)			
≤10 point	280 (85.1)	49 (14.9)	0.630
11 and above	62 (87.3)	9 (12.7)	
q-SOFA, n (%)			
0–1 point	317 (93.5)	22 (6.5)	<0.001
2–3 points	25 (41.0)	36 (59.0)	
Shock index	0.65 (0.57–0.76)	0.85 (0.69–1.14)	<0.001

M: male; F: female; SBP: systolic blood pressure; DBP: diastolic blood pressure; ED: emergency department; CRP: C-reactive protein; LDH: lactate dehydrogenase; NEWS: national early warning score; q-SOFA: quick sequential organ failure assessment.

Table 3. Association between risk factors and mortality in the patients with COVID-19 and pairwise comparisons of receiver operating characteristic curves.

	ICU admission			
	Univariable OR (95%CI)	p-value	Multivariable OR (95%CI)	p-value
Age	1.015 (0.980–1.051)	0.405		
Sex				
Female	Ref.			
Male	1.068 (0.607–1.878)	0.820		
NEWS				
0–10 points	Ref.			
≥10 points	0.829 (0.387–1.778)	0.631		
q-SOFA				
0–1 point	Ref.			
2–3 points	20.749 (10.632–40.494)	<0.001	19.810 (7.474–52.504)	<0.001
Shock index	52.465 (14.346–191.875)		7.954 (1.600–39.555)	0.011
Chronic disease				
None	Ref.			
1	0.412 (0.164–1.036	0.060		
2 and above	0.615 (0.280–1.350)	0.225		
Complaints at the ED admission				
Cough	0.278 (0.128–0.605)	0.001		
Dyspnea	6.481 (2.860–14.686)	<0.001	6.420 (2.044–20.164)	0.001
Fatigue	0.310 (0.108–0.886)	0.029		
Laboratory parameter				
Lymphocyte	1.000 (0.970–1.030)	0.995		
CRP	1.038 (1.010–1.068)	0.008		
Base deficit	0.896 (0.853–0.942)	<0.001		
Lactate	1.269 (1.101–1.462)	0.001		
Bicarbonate	0.856 (0.806–0.910)	<0.001		
D-Dimer	1.000 (1.000–1.000)	0.025		
Urea	1.012 (1.007–1.017)	<0.001	1.010 (1.002–1.018)	0.012
LDH	1.002 (1.000–1.003)	0.009		

Prognostic model	Area under the ROC curve (95%CI)	Pairwise analysis					
		DBA	SE	95%CI		Z-statistic	p-value
				Lower	Upper		
Base model=Dyspnea+SI+Urea	0.825 (0.760–0.883)	0.058	0.236	0.022	0.093	3.180	0.001
Base model+q-SOFA	0.883 (0.830–0.936)						

ICU: intensive care unit; OR: odds ratio; CI: confidence interval; NEWS: national early warning score; q-SOFA: quick sequential organ failure assessment; ED: emergency department; CRP: C-reactive protein; LDH: lactate dehydrogenase; ROC: receiver operating characteristic; SE: standard error.

and D-dimer[4,27,28]. In our study, unlike lymphopenia, base deficit and bicarbonate were found to be low. CRP, D-dimer, urea, and LDH levels were high, whereas lactate levels were high. These results were statistically significant, which are in line with the findings of the studies in the literature.

In the patients aged above 65 years with a diagnosis of COVID-19, the NEWS gave the most accurate score for both ICU admission and mortality estimation[29]. In our study, the NEWS was not significant for both groups. Due to the additional diseases of patients aged above 65 years and the reflection of these diseases on vital signs, it has been observed that it is as high in patients who are followed up in the service without the need for intensive care as in the patients in the ICU. In a retrospective study with patients with COVID-19, q-SOFA is recommended for the prediction of respiratory failure and mortality[30]. Doğanay et al.[13] stated that the SI is a useful parameter for mortality prevention, early intervention, and hospitalization of elderly patients and patients with COVID-19 with low oxygen saturation[13]. In our study, the use of q-SOFA in patients aged above 65 years with SI was found to be more effective in the prediction of admission to the ICU.

CONCLUSION

In age group of ³65 years, q-SOFA, SI, dyspnea, and urea elevation are effective in predicting the need for intensive care.

AUTHORS' CONTRIBUTIONS

CA: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **MD:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **OB:** Investigation, Writing – original draft, Writing – review & editing. **GA:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **OA:** Writing – review & editing.

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