Jpn. J. Infect. Dis., 73, 323-329, 2020

Original Article

Comparison of the Predictive Performances of qSOFA, APACHE II, and SGS for Evaluation of the Disease Prognosis of CCHF Patients at the Emergency Department

Erdal Demirtas[1]*, Mehmet Bakir[2], Seyit Ali Buyuktuna[2], Caner Oksuz[2], Murtaza Oz[2], Kıvanc Cebecioglu[1], and Meltem Unlusavuran[3]

[1]*Department of Emergency Medicine and* [2]*Department of Infectious Disease and Clinical Microbiology, Faculty of Medicine, University of Sivas Cumhuriyet, Sivas; and*
[3]*Department of Biostatistics, Faculty of Medicine, University of Erciyes, Kayseri, Turkey*

SUMMARY: In this study, we compared the predictive performances of quick sequential organ failure assessment (qSOFA), the acute physiology and chronic health evaluation (APACHE II) scores, and the severity grading score (SGS) for evaluation of the disease prognosis of patients with Crimean-Congo hemorrhagic fever (CCHF) at the emergency department. We recorded the qSOFA, SGS, and APACHE II scores at admission and at the 72nd and 120th hour in 97 patients admitted to the emergency department and diagnosed with CCHF. In our study, the area under a receiver operating characteristic curve values of qSOFA, SGS, and APACHE II at admission were found to be 0.640, 0.824, and 0.576, respectively. No statistical significance was found for a qSOFA score ≥ 2 at admission as a predictor of mortality. The use of qSOFA score for diseases with a mortal prognosis such as CCHF is insufficient in predicting the prognosis.

INTRODUCTION

Crimean-Congo hemorrhagic fever (CCHF) is a mortal zoonotic disease transmitted through tick bites and characterized by fever and bleeding (1). CCHF is endemic in Africa, the Middle East, Asia, and some regions of Southeast Europe (2). The virus is carried by hard-bodied *Hyalomma* ticks of the *Ixodes* family of which *Hyalomma marginatum* is the most common species (3).

The disease may progress subclinically and mildly; it may also cause bleeding and multi-organ failure, leading to death (4). The incubation period of the disease ranges from 1 to 13 days depending on viral load and the type of transmission.

The incubation period following a tick bite is 1 to 3 days following contact with blood, and 3 to 7 days following contact with body fluids (5). Endothelial damage, disruption of the coagulation cascade, thrombocytopenia, and, ultimately, bleeding are seen in the pathophysiology of severe cases of CCHF (2). In the last Sepsis-3.0 consensus, organ dysfunction due to irregular response of the host against the infection had been defined as sepsis (6); therefore, severe cases of CCHF can be defined as sepsis.

Evaluation of sepsis in emergency departments is a process which should be performed quickly. For this purpose, several scoring systems have been developed. The quick sequential organ failure assessment (qSOFA) is recommended for the evaluation of patients with suspected sepsis except for intensive care cases. The qSOFA criteria consists of 3 simple clinical parameters (respiratory rate ≥ 22/min, altered mentation (Glasgow coma score [GCS] < 15) and systolic blood pressure ≤ 100 mmHg). The variables used in qSOFA and the points for each variable are listed in Table 1. A qSOFA score ≥2 at the beginning of infection is associated with a high risk of mortality and prolonged stay in intensive care (7). The acute physiology and chronic health evaluation (APACHE II) score is a routinely used scoring system for the overall measurement of disease severity. APACHE II is a point score based upon initial values of 12 routine physiologic measurements. The variables are internal temperature, heart rate, mean arterial pressure, respiratory rate, oxygenation, arterial pH, serum sodium, serum potassium, serum creatinine, hematocrit, white blood cells count, and Glasgow coma scale (8).

Severity grading score (SGS), which was developed for CCHF, is a scoring system used to evaluate the disease severity of CCHF patients and consists of 14 parameters (9). The variables used in the SGS system and the points for each variable are listed in Table 1.

The qSOFA score is a straightforward scoring system

Received December 24, 2019. Accepted March 12, 2020.
J-STAGE Advance Publication April 30, 2020.
DOI: 10.7883/yoken.JJID.2019.507
*Corresponding author: Mailing address: Department of Emergency Medicine, Faculty of Medicine, University of Sivas Cumhuriyet, Sivas, Turkey. Sivas Cumhuriyet Universitesi, 58140 Kampus/Sivas, Turkey. Tel : +90 346 258 00 00, Fax: +90 346 258 00 24, E-mail: demirtas.erdal@hotmail.com

Table 1. Variable of the severity grading score (SGS) system and quick Sequential (Sepsis-Related) Organ Failure Assessment (qSOFA)

Severity grading score (SGS) system		
Items	Classification	SGS points
Aspartate transaminase	< 5 × ULNV	0
	≥ 5 × ULNV	1
Alanine transaminase	< ULNV	0
	≥ ULNV	1
Lactate dehydrogenase	< 3 × ULNV	0
	≥ 3 × ULNV	1
White blood cells	< 10,000 cells/μL	0
	≥ 10,000 cells/μL	1
Hepatomegaly	No	0
	Yes	1
Organ failure	No	0
	Yes	1
Bleeding	No	0
	Yes	1
Age	< 60 years	0
	≥ 60 years	1
Platelets	≥ 100,000 cells/μL	0
	≥ 50,000, < 100,000 cells/μL	1
	< 50,000 cells/μL	2
Prolongation of PT	< 3 s	0
	≥ 3 s, < 6 s	1
	≥ 6 s	2
aPTT	< 70	0
	≥ 70	1
INR	< 1.6	0
	≥ 1.6	1
ULNV upper limit of normal value; PT prothrombin time; aPTT activated partial thromboplastin time; INR international normalized ratio		
quick Sequential (Sepsis-Related) Organ Failure Assessment (qSOFA)		
Respiratory rate ≥22/min		1
Altered mentation		1
Systolic blood pressure ≤100 mm Hg		1

that can be used in the initial assessment of patients in emergency departments and does not require laboratory data. By contrast, SGS and APACHE II scores are more complex systems that require laboratory data and take more time. There is no study in the literature about the use of qSOFA in the evaluation of CCHF disease severity. Based on the current information, we hypothesized that the practicality of qSOFA scoring at the first admission to the emergency department could be favorable for evaluating the disease prognosis of CCHF patients.

The objective of this study was to determine the performance of qSOFA for predicting mortality in patients with clinically diagnosed CCHF in the emergency department and to compare its performance with that of SGS and APACHE II.

MATERIALS AND METHODS

We included all cases of CCHF observed in the Sivas region in the study. In our center, CCHF cases have been monitored since 2002 and the incidence of the disease has been reported as 3.99–15.05 per 100,000 between 2002 and 2017, according to national health authority data (10). In our country, 9.1%–15.8% of all cases of CCHF between 2011 and 2017 were followed up in our center (11).

This study was a single-center prospective study evaluating patients who presented to the emergency department and were diagnosed with CCHF between March 2019 and November 2019. The scores at admission were obtained for all patients. Patients with positive CCHF virus by reverse transcription-polymerase chain reaction (RT-PCR) or positive CCHF-specific IgM with enzyme-linked immunosorbent assay (ELISA) were included in the study. qSOFA, SGS, and APACHE II scores at admission and at the 72nd and 120th hours were recorded for all patients diagnosed. Patients' demographic data, such as age and gender, were recorded. In addition, patients' white blood cell count (WBC), platelet count (PLT), hemoglobin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), lactate dehydrogenase (LDH), prothrombin time (PT), partial thromboplastin time (PTT), international normalized ratio (INR), D-Dimer, fibrinogen, and C-reactive protein (CRP) laboratory tests were studied. Patients with cardiac arrest at admission and those with a negative RT-PCR were excluded from the study. All patients with CCHF were followed-up until mortality or full recovery. The study protocol was approved by the Sivas Cumhuriyet University ethics committee (2019-04/02).

All patients and/or their relatives were informed about the study and gave written consent. The study was conducted following the ethical principles of the Declaration of Helsinki.

Diagnosis of CCHF: Acute-phase serum samples were sent to the Virology Laboratory of Refik Saydam Hygiene Center in Ankara, Turkey, for serological and virological analyses. The definitive diagnosis of CCHF was based on typical clinical, epidemiological, and laboratory findings. In this study sera samples sent to the laboratory were tested by PCR (Altona RealStar® CCHFV RT-PCR Kit 1.0, Hamburg, Germany) and IFA IgM (CCHFV Mosaic 2, Euroimmun, Luebeck, Germany) methods.

The patients included in the study are treated basically according to their symptoms and the severity of the disease. In general, the routine treatment protocol in such cases is similar to the one described by Leblebicioglu et al. (12).

Statistical Analyses: The normality of the data was evaluated using histograms, q-q plots, and the Shapiro-Wilk test. Comparison of quantitative variables between the survivor and non-survivor groups was performed using the Mann-Whitney U test. Correlations between categorical variables were evaluated using the Chi-square test. A Bonferroni test was used in multiple test comparisons. Logistic regression analysis was used in

Table 2. Comparison of mortality status and descriptive variables and laboratory parameters

Variables		Mortality		*p*
		Survivors (*n* = 85)	Non-survivors (*n* = 12)	
Age	Normal range	46 (33-62)	54 (36-70)	0.305
Gender				
Male		52 (61.2)	9 (75.0)	0.526
Female		33 (38.8)	3 (25.0)	
WBC, 10^9 /L	4,000-10,500	2,570 (1,950-3,550)	6,335 (3,760-9,720)	< 0.001
PLT, 10^9 /L	150,000-450,000	109,000 (670,00-133,000)	45,500 (14,000-96,000)	0.008
Hemoglobin, g/dL	12.5-16	14.3 (13.4-15.3)	13.3 (12.4-15.15)	0.190
ALT, U/L	0-50	36 (23-65)	48.5 (23-113)	0.511
AST, U/L	0-50	65 (37-117)	169.5 (53-262.5)	0.038
LDH, U/L	125-240	351 (269-464)	472.5 (284-1,244.5)	0.100
PT, sec.	10.7-13	13 (11.7-14.4)	16.85 (14.5-17.8)	0.001
PTT, sec.	22-36.9	33 (30.4-36.8)	34.5 (31.4-47.4)	0.370
İNR	0,89-1.1	1.13 (1.02-1.26)	1.46 (1.26-1.54)	0.003
D-Dimer, ng/mL	0-243	701.5 (371-2,385)	12341 (3,572-42,448)	< 0.001
Fibrinogen, mg/dL	200-393	280 (245-328)	205.5 (158.5-303.5)	0.023
CRP, mg/dL	0-8	15 (6.9-32)	69.5 (36.5-99.0)	< 0.001
At 72h				
WBC, 10^9 /L	4,000-10,500	2,470 (1,850-3,480)	6515 (3,830-11,735)	< 0.001
PLT, 10^9 /L	150,000-450,000	72,000 (40,000-104,000)	16500 (12,500-23,000)	< 0.001
Hemoglobin, g/dL	12.5-16	14.3 (13.3-15.3)	13.95 (11.55-14.85)	0.230
ALT, U/L	0-50	46 (30-82)	143 (53-190.5)	0.007
AST, U/L	0-50	83 (42-162)	398.5 (253-638)	< 0.001
LDH, U/L	125-240	385 (286-540)	2164 (1,119.5-3,183)	< 0.001
PT, sec.	10.7-13	11.7 (11-12.4)	15 (13.4-17.8)	< 0.001
PTT, sec.	22-36.9	33.4 (29.9-36)	54.7 (45-68.7)	< 0.001
INR	0,89-1.1	1.02 (0.96-1.09)	1.3 (1.16-1.53)	< 0.001
D-dimer, ng/mL	0-243	486 (298.5-983.5)	34861 (6,476-47,021)	< 0.001
Fibrinogen, mg/dL	200-393	274 (242-308.5)	167 (123-244)	< 0.001

Abbreviations: WBC, white blood cell count; PLT, platelet count; ALT, alanine aminotransferase; AST, aspartate aminotransferase; LDH, lactate dehydrogenase; PT, prothrombin time; PTT, partial thromboplastin time; INR, international normalized ratio; CRP, c-reactive protein.
Note: Data are given as *n* (%) and median (25.quartile-75.quartile).

order to determine the factors affecting mortality. The variables that were found to be significant with logistic regression analysis were evaluated using multivariate regression analysis. Receiver operating characteristic (ROC) analysis was performed for the evaluation of qSOFA, APACHE II, and SGS scores in predicting mortality. The area under the curve (AUC) and cut-off values were calculated for each score. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated in order to evaluate the performance of each score. The level of statistical significance was set at $p < 0.05$. Analysis of the data was performed using TURCOSA (Turcosa Analytics Ltd Co, Kayseri, Turkey) statistical software.

RESULTS

A total of 97 patients were included in the study, of whom 12 (12.4%) had a mortal progression and 85 (87.6%) were discharged after full recovery. The median age of the patients was 54 (36–70) years in the non-survivor group and 46 (33–62) years in the survivor group. In the survivor group, 52 (53.6%) were males and 33 (34.0%) were females, while in the non-survivor group, 9 (75.0%) were males and 3 (25.0%) were females. A comparison of the mortality status and descriptive variables and laboratory parameters is shown in Table 2.

Table 3. Comparison of qSOFA, SGS, and APACHE II scores according to mortality status

Variables	Mortality		*P*
	Survivors (*n* = 85)	Non- survivors (*n* = 12)	
qSOFA on admission			
< 2	78 (91.8)	9 (75.0)	0.106
≥ 2	7 (8.2)	3 (25.0)	
qSOFA at 72h			
< 2	71 (84.5)	5 (41.7)	0.003
≥ 2	13 (15.5)	7 (58.3)	
qSOFA at 120h			
< 2	48 (84.2)	2 (25.0)	0.001
≥ 2	9 (15.8)	6 (75.0)	
SGS on admission			
Mild	73 (85.9)	6 (50.0)	0.004
Intermediate	12 (14.1)	5 (41.7)	
Severe	0 (0.0)	1 (8.3)	
SGS at 72h			
Mild	70 (83.3)	1 (8.3)	< 0.001
Intermediate	14 (16.7)	8 (66.7)	
Severe	0 (0.0)	3 (25.0)	
SGS at 120h			
Mild	47 (82.5)	0 (0.0)	< 0.001
Intermediate	10 (17.5)	5 (62.5)	
Severe	0 (0.0)	3 (37.5)	
APACHE II on admission	4.0 (2.0/6.0)	4.5 (1.5/10.5)	0.393
APACHE II at 72h	4.0 (2.0/6.0)	6.0 (2.0/8.5)	0.159
APACHE II at 120h	3.0 (2.0/5.0)	5.5 (2.5/8.0)	0.168

Abbreviations: qSOFA, the quick sequential related organ failure assessment score; APACHE II, acute physiology and chronic health evaluation; SGS, severity grading score. Data are given as *n* (%) and median (25.quartile-75.quartile).

Comparison of qSOFA, SGS, and APACHE II scores at admission and at the 72nd and 120th hours according to mortality status is shown in Table 3.

In this comparison, no significant difference was found between the 2 groups in terms of the qSOFA scores < 2 and ≥ 2 calculated at admission ($p = 0.106$). A qSOFA score calculated as ≥ 2 at the 72nd hour was found to be statistically significant in favor of mortality ($p < 0.05$). A qSOFA score calculated as ≥ 2 at the 120th hour was found to be statistically significant in favor of mortality ($p < 0.05$). The SGS scores measured at admission and at the 72nd hour and 120th hour were found to be statistically significant in favor of mortality ($p < 0.001$). The rate of patients with a mild SGS score was higher in the survivor group, while the rate of patients with an intermediate or severe SGS score was higher in the non-survivor group. No statistically significant difference was found between the groups in terms of APACHE II scores measured at admission and at the 72nd hour and 120th hour ($p > 0.05$).

Risk factors affecting mortality are shown in Table 4.

The qSOFA, APACHE II, and SGS scores measured at admission and at the 72nd hour and 120th hour were evaluated using multivariate logistic regression analysis. As a result of this analysis, the SGS score measured at admission was found to be a significant independent risk factor ($p < 0.05$), and an increase of 1 unit in the SGS score increased the risk of mortality 1.710-fold. When the scores measured at the 72nd hour were evaluated, the SGS score was found to be a statistically significant independent risk factor, and an increase in SGS at 72 h post admission increased the risk of mortality 2.558-fold. No statistically significant risk factor was found when the scores measured at the 120th hour were evaluated. The SGS score measured at the 120th hour could not be evaluated in univariate and multivariate regression analyses. This was due to the lack of patients who died with a mild SGS score and patients who were discharged with a severe SGS score.

Sensitivity, specificity, positive predictive value, negative predictive value, and AUC of the scores at admission and at the 72nd and 120th hour calculated

Table 4. Risk factors affecting mortality

Variables	Univariate		Multivariate	
	OR (95% CI)	*p*	OR (95% CI)	*p*
On admission				
qSOFA				
< 2	1			
≥ 2	3.714 (0.814-16.954)	0.090		
APACHE II	1.164 (0.979-1.383)	0.085		
SGS	1.721 (1.299-2.281)	< 0.001	1.710 (1.255-2.330)	0.001
At 72h				
qSOFA				
< 2	1			
≥ 2	7.646 (2.103-27.805)	0.002		
APACHE II	1.193 (1.008-1.413)	0.040		
SGS	2.703 (1.612-4.532)	< 0.001	2.558 (1.457-4.492)	0.001
At 120h				
qSOFA				
< 2	1			
≥ 2	16.000 (2.776-92.214)	0.002		
APACHE II	1.167 (0.937-1.455)	0.168		
SGS	-	-		

Abbreviations: qSOFA, the quick sequential related organ failure assessment score; APACHE II, acute physiology and chronic health evaluation; SGS, severity grading score; OR, odds ratio; CI: confidence interval.

Table 5. Statistical diagnostic measures of qSOFA, SGS, and APACHE scores in discriminating survivor and non-survivor status

Variables	Statistical diagnostic measures				ROC curve statistics	
	SEN (95%CI)	SPE (95%CI)	PPV (95%CI)	NPV (95%CI)	AUC	*p*
On admission						
qSOFA (≥ 2)	0.25 (0.06-0.57)	0.92 (0.84-0.97)	0.30 (0.17-0.63)	0.90 (0.60-0.96)	0.640	0.076
APACHE (≥ 8)	0.42 (0.15-0.72)	0.89 (0.80-0.95)	0.36 (0.22-0.67)	0.91 (0.73-0.96)	0.576	0.501
SGS (≥ 7)	0.50 (0.21-0.79)	0.97 (0.90-0.99)	0.67 (0.40-0.88)	0.93 (0.79-0.99)	0.824	< 0.001
At 72h						
qSOFA (≥ 2)	0.58 (0.27-0.84)	0.85 (0.75-0.92)	0.35 (0.23-0.68)	0.93 (0.80-0.97)	0.756	0.001
APACHE (≥ 7)	0.50 (0.21-0.79)	0.79 (0.70-0.88)	0.26 (0.17-0.57)	0.92 (0.75-0.95)	0.625	0.223
SGS (≥ 5)	0.92 (0.62-0.99)	0.83 (0.74-0.91)	0.44 (0.31-0.97)	0.99 (0.91-0.99)	0.946	< 0.001
At 120h						
qSOFA (≥ 2)	0.75 (0.35-0.97)	0.84 (0.72-0.93)	0.40 (0.24-0.87)	0.96 (0.81-0.98)	0.853	< 0.001
APACHE (≥ 5)	0.63 (0.25-0.92)	0.70 (0.57-0.82)	0.23 (0.14-0.65)	0.93 (0.72-0.96)	0.650	0.146
SGS (≥ 8)	1.00 (0.63-0.99)	1.00 (0.94-0.99)	1.00 (0.68-0.99)	1.00 (0.92-0.99)	0.999	< 0.001

Abbreviations: qSOFA, the quick sequential related organ failure assessment score; APACHE II, acute physiology and chronic health evaluation; SGS, severity grading score; SEN, sensitivity; SPE, specificity; PPV, positive predictive value; NPV, negative predictive value; AUC, area under curve, ROC, receiver operating characteristic; CI, confidence interval.

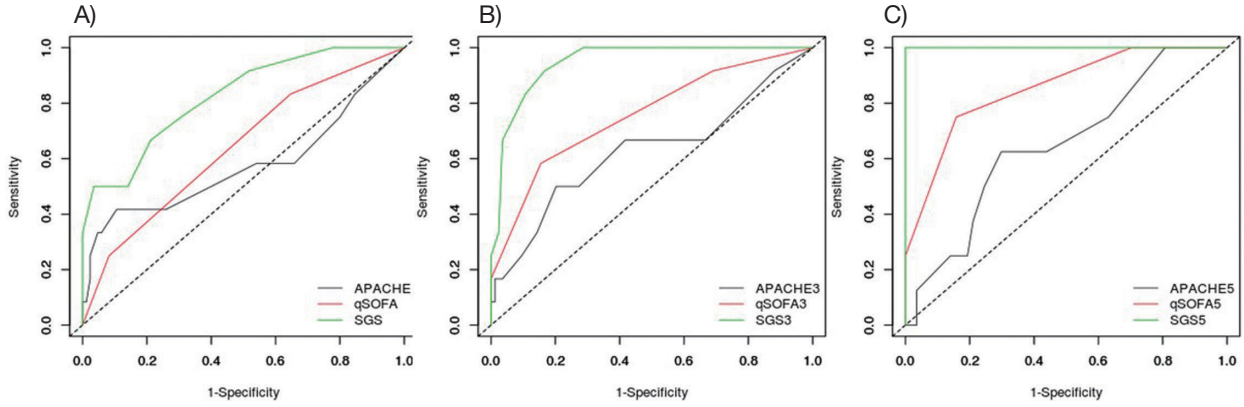


Fig.1. (Color online) A) ROC analysis plot of the tests performed at admission. B) ROC analysis plot of the tests performed at 72nd hour. C) ROC analysis plot of the tests performed at 120th hour.

using ROC analysis are shown in Table 5.

Only the SGS score at admission yielded statistically significant data; the SGS diagnostic test was found to be statistically significant in predicting mortality (SEN [95% CI]: 0.50 (0.21–0.79), SPE [95% CI]: 0.97 (0.90–0.99), PPV [95% CI]: 0.67 (0.40–0.88), NPV [95% CI]: 0.93 (0.79–0.99), AUC: 0.824, $p < 0.001$). The qSOFA and SGS scores measured at the 72nd hour were found to be statistically significant in predicting mortality ($p < 0.001$). The qSOFA and SGS scores measured at the 120th hour were also found to be statistically significant in predicting mortality ($p < 0.001$). The ROC analysis plot of the tests performed at admission and at the 72nd and 120th hour is shown in Fig. 1.

DISCUSSION

The rate of mortality from CCHF typically differs between 5% and 40%, and the first approach in the management of CCHF is general supportive care with the treatment of symptoms. Although the pathogenesis of CCHF is not fully understood, it is hypothesized that deregulation and excessive secretion of cytokines have toxic effects on the endothelium, leading to increased vasodilatation, vascular permeability, shock, multiple organ failure, and mortality in severe cases. The pathogenesis of CCHF is similar to that of sepsis in some aspects, but there are a lot of differences. Deregulated cytokine storm causes a systemic vascular collapse in both conditions (13,14). It is essential to evaluate this fatal disease in emergency departments quickly and to initiate treatment without delay.

In the present study, we compared qSOFA scoring with SGS and APACHE II scoring systems in order to determine the prognostic value of qSOFA scoring in the evaluation of mortality in CCHF. We found that a qSOFA score ≥ 2 at admission was not significant in predicting mortality. However, a qSOFA score ≥ 2 at the 72nd and 120th hours of hospitalization was significantly correlated with mortality. The SGS scores measured at admission and at the 72nd and 120th hour as ≥ 7, ≥ 5, and ≥ 8, respectively, were found to be significant pointers of mortality.

In a study by Seymour et al. with a cohort of 148,907 patients with suspected infection, mortality occurred in 4% of the patients, and the predictive validity of qSOFA was found as good for in-hospital mortality (AUROC = 0.81; 95% CI, 0.80–0.82) (15).

In a study by Singer et al. investigating the predictive value of qSOFA score for mortality in patients who were receiving intravenous antibiotics for suspected infection with CCHF in the emergency department, the qSOFA score was found to be correlated with mortality (0 [0.6%], 1 [2.8%], 2 [12.8%], and 3 [25.0%]). The authors reported that the qSOFA score could be used in emergency departments for predicting mortality in the presence of suspected infection (16). Additionally, in a study by Wang et al. that was conducted in order to determine the predictive performance of qSOFA score in emergency departments for the evaluation of mortality and hospitalization to intensive care for patients with CCHF, SOFA, mortality in emergency department sepsis (MEDS), APACHE II, and qSOFA scores were compared in terms of predicting hospitalization in ICU and 28-day mortality. According to the ROC analysis of the scores measured at admission in predicting 28-day mortality, the AUC values of qSOFA, SOFA, (MEDS), and APACHE II were found to be 0.666, 0.729, 0.751, and 0.732, respectively, and the cut-off value of qSOFA was found to be 2. The odds ratio of this score was found as 3.6 for mortality. The authors stated that the ability of qSOFA score to predict mortality was similar to that of the SOFA and APACHE II scores and lower than the MEDS score (17). In a study by Freund et al. investigating the prognostic value of qSOFA in predicting mortality in patients presenting to the emergency department with suspected infection, qSOFA had a sensitivity of 70% (95% CI, 59%–80%) and a specificity of 79% (76%–82%) for predicting in-hospital mortality. The authors reported that these rates were higher than those of Systemic Inflammatory Response Syndrome (SIRS) and severe sepsis scores and were similar to the Sepsis 3.0 criteria (18). Unlike these studies, in our study, the qSOFA score measured at admission was insufficient for predicting mortality; however, the qSOFA scores measured at the 72nd and 120th hours yielded similar results to those of the aforementioned studies (AUC-ROC: 0.756 and 0.853, respectively). In our study, SGS scores measured at admission and at the 72nd and 120th hours were

successful in predicting mortality. We believe that the use of SGS scoring in the evaluation of patients with CCHF, a rarely observed disease, would be beneficial.

In a study by Choi et al., which compared the prognostic performance of scoring systems in the evaluation of patients with septic shock, the qSOFA, SIRS, SOFA, and APACHE II scores were evaluated. In that study, it was found that all scoring systems were inadequate in the discrimination of 28-day mortality (19). In a study by Haydar et al. comparing qSOFA and SIRS criteria for sepsis screening in the emergency department, AUC-ROC was found to be 0.51 (95% CI: 0.38–0.63) for SIRS criteria and 0.68 (0.58–0.78) for qSOFA score. The authors reported that qSOFA scoring has low performance in the quick evaluation of disease severity in emergency departments and stated that relying only on qSOFA as a sepsis-screening tool in emergency departments may cause treatment delays (20). Our results are similar to those of the aforementioned studies, and AUC-ROC values of the qSOFA scores at admission were found to be similar to those of these studies. The qSOFA score measured at admission was insufficient in predicting mortality in CCHF patients. As recommended by Williams et al., the scores that have been developed for similar patient groups could be more successful in predicting mortality (21). In our study too, SGS scoring, which has been developed for CCHF, was much more successful in predicting mortality.

In conclusion, The qSOFA score, which is used in the early evaluation of disease severity of sepsis, is non-specific and insufficient for the assessment of CCHF at admission. There is a crucial need for a screening method for the early evaluation of CCHF. The present study demonstrates that SGS is capable as an initial assessment of disease severity of CCHF at admission in the emergency department. Nonetheless, there is a need for further evaluation and verification of the success of this test in clinical trials.

Conflict of interest None to declare.

REFERENCES

1. Whitehouse CA. Crimean-Congo hemorrhagic fever. Antiviral Res. 2004; 64:145-60.
2. Papa A, Mirazimi A, Köksal I, et al. Recent advances in research on Crimean-Congo hemorrhagic fever. J Clin Virol. 2015; 64:137-43.
3. Anagnostou V, Papa A. Evolution of Crimean-Congo hemorrhagic fever virus. Infect Genet Evol. 2009; 9:948-54.
4. Yilmaz GR, Buzgan T, Irmak H, et al. The epidemiology of Crimean-Congo hemorrhagic fever in Turkey, 2002–2007. Int J Infect Dis. 2009; 13:380-6.
5. Vorou R, Pierroutsakos IN, Maltezou HC. Crimean-Congo hemorrhagic fever. Curr Opin Infect Dis. 2007; 20:495-500.
6. Singer M, Deutschman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock (Sepsis-3). JAMA. 2016;315:801-10.
7. Haas LEM, Termorshuizen F, de Lange DW, et al. Performance of the quick SOFA in very old ICU patients admitted with sepsis. Acta Anaesthesiol Scand. 2020; 64: 508-16.
8. Knaus WA, Draper EA, Wagner DP, et al. APACHE II: a severity of disease classification system. Crit Care Med. 1985;13:818-29.
9. Bakır M, Gözel MG, Köksal I, et al. Validation of a severity grading score (SGS) system for predicting the course of disease and mortality in patients with Crimean-Congo hemorrhagic fever (CCHF). Eur J Clin Microbiol Infect Dis. 2015; 34: 325-30.
10. Republic of Turkey Ministry of Health, General Directorate of Public Health, Zoonotic and Vectorial Diseases Unit. Available at <https://hsgm.saglik.gov.tr/depo/birimler/zoonotikvektorel-hastaliklar-db/zoonotik-hastaliklar/1-KKKA/3-istatistik/KKKA_Haritalar_2017_Dahil.pdf>. Accessed February 20, 2020. Turkish.
11. Republic of Turkey Ministry of Health, General Directorate of Public Health, Zoonotic and Vectorial Diseases Unit. Available at <https://hsgm.saglik.gov.tr/tr/zoonotikvektorel-kkka/zoonotikvektorel-kkka-istatistik>. Accessed February 20, 2020. Turkish.
12. Leblebicioglu H, Bodur H, Dokuzoguz B, et al. Case management and supportive treatment for patients with Crimean-Congo hemorrhagic fever. Vector Borne Zoonotic Dis. 2012; 12:805-11.
13. Akinci E, Bodur H, Leblebicioglu H. Pathogenesis of Crimean-Congo hemorrhagic fever. Vector Borne Zoonotic Dis. 2013; 13:429-37.
14. Connolly-Andersen AM, Moll G, Andersson C, et al. Crimean-Congo hemorrhagic fever virus activates endothelial cells. J Virol. 2011; 85:7766-74.
15. Seymour CW, Liu VX, Iwashyna TJ, et al. Assessment of clinical criteria for sepsis for the third international consensus for sepsis and septic shock (Sepsis-3). JAMA. 2016; 315: 762-74.
16. Singer AJ, Ng J, Thode HC Jr, et al. Quick SOFA scores predict mortality in adult emergency department patients with and without suspected infection. Ann Emerg Med. 2017; 69: 475-9.
17. Wang JY, Chen YX, Guo SB, et al. Predictive performance of quick sepsis-related organ failure assessment for mortality and ICU admission in patients with infection at the ED. Am J Emerg Med. 2016; 34: 1788-93.
18. Freund Y, Lemachatti N, Krastinova E, et al. French Society of Emergency Medicine Collaborators Group. Prognostic accuracy of sepsis-3 criteria for in-hospital mortality among patients with suspected infection presenting to the emergency department. JAMA. 2017; 317:301-8.
19. Choi A, Park YS, Shin TG, et al. Korean shock society (KoSS) investigators. Prognostic performance of disease severity scores in patients with septic shock presenting to the emergency department. Am J Emerg Med. 2019; 37:1054-9.
20. Haydar S, Spanier M, Weems P, et al. Comparison of QSOFA score and SIRS criteria as screening mechanisms for emergency department sepsis. Am J Emerg Med. 2017; 35: 1730-3.
21. Williams JM, Greenslade JH, Chu K, et al. Severity scores in emergency department patients with presumed infection: a prospective validation study. Crit Care Med. 2016; 44: 539-47.