

Early warning score versus quick sequential organ failure assessment in COVID-19

EWS vs qSOFA in COVID-19

Mehmet Tunç¹, Kemal Sener², Nurettin Yılmaz¹, Tufan Nayir³, Sadiye Yolcu¹¹ Department of Emergency Medicine, Adana City Research and Education Hospital, Adana² Department of Emergency Medicine, Başakşehir Çam and Sakura City Hospital, İstanbul³ Ministry of Health Ankara, Turkey

Abstract

Aim: COVID-19 is a viral pandemic that has affected the whole world in 2020. Our knowledge about this infection is improving each day. The emergency department (ED) management of COVID-19 patients is still unclear. Early warning scores (EWSs) and quick sequential organ failure assessment (qSOFA) are widely used scores in the ED. In this study, we aimed to compare EWSs and qSOFA scores in COVID-19 patients.

Material and Methods: We evaluated patients diagnosed and hospitalized with COVID-19 between 10 April 2020 and 17 April 2020, including 63 COVID-19-positive patients. We calculated both EWSs and qSOFA scores for all patients and compared them by hospitalization unit (clinic or intensive care unit [ICU]), hospitalization length, and outcome.

Results: EWS was positively correlated with hospitalization length, but we could not find a relationship between qSOFA and hospitalization length. The ICU hospitalization rate increases with high EWSs AND qSOFA scores. The mean EWS of patients hospitalized in the inpatient clinic was 1.39 and that of patients hospitalized in the ICU was 5.7. These scores were significantly different ($p=0.000$). The mean EWS of the patients who were discharged from the hospital was 1.6, and that of the exitus patients was 11.7 ($p = 0.01$). These values were 0.06 and 2.25 for qSOFA, respectively.

Discussion: Both qSOFA and EWSs can predict the hospitalization unit and mortality, but EWSs are superior in determining the hospitalization length of COVID-19 patients.

Keywords

COVID-19, Early Warning Score, qSOFA

DOI: 10.4328/ACAM.21080 Received: 2022-01-24 Accepted: 2022-03-05 Published Online: 2022-03-15 Printed: 2022-06-01 Ann Clin Anal Med 2022;13(6):659-662

Corresponding Author: Kemal Şener, Department of Emergency Medicine, Başakşehir Çam and Sakura City Hospital İstanbul, Turkey.

E-mail: drkemalsener@hotmail.com P: +90 506 915 62 12

Corresponding Author ORCID ID: <https://orcid.org/0000-0002-8579-6663>

Introduction

An early warning score (EWS) measures respiratory rate, oxygen saturation, heart rate, systolic blood pressure, and consciousness level according to AVPU for determining the severity of the illness in the emergency department (ED; Table 1). A score of 0 to 1 means mild conditions, and patients with a score of 2 should be observed much more carefully. Additional immediate evaluation and treatment should be provided to patients with a score of 3 to 5. Patients who score 6 to 8 points require much more extensive evaluation, and patients with an EWS ≥ 9 should consult with a senior expert physician. EWSs reflect the severity of a disease, with high scores predicting worse prognoses (Royal College of Physicians (London) Report of a working party; 2012. National Early Warning Score (NEWS). Standardising the Assessment of Acute-Illness Severity in the NHS).

The quick sequential organ failure assessment (qSOFA) score was suggested for sepsis and septic shock in 2016. This score is used to predict the sepsis risk and in-hospital mortality (range, 0-3, receiving 1 point for each of the following criteria that are met: systolic arterial blood pressure ≤ 100 mmHg; respiratory rate > 21 breaths/min; or altered mental status) [1].

The development of sepsis is frequently seen in cases of pneumonia, especially in pneumonia due to COVID-19 [2].

In this study, we aimed to compare EWSs and qSOFA in COVID-19 patients and to determine which score better predicts the prognosis of the patients.

Material and Methods

After obtaining approval from the XXX Research and Education Hospital Ethics Committee, in this retrospective study, we evaluated patients diagnosed and hospitalized with COVID-19 between 10 April 2020 and 17 April 2020, including 63 COVID-19-positive patients. We validated the positivity via a combined oro-nasopharyngeal swab PCR test. We noted demographic data (age, gender, comorbidities), EWS, qSOFA, hospitalization unit (clinic/intensive care unit [ICU]), hospitalization length, and outcome. We calculated and compared EWSs and qSOFA for all patients.

All patients included in the study were diagnosed and hospitalized with COVID-19. The exclusion criteria were patients with missing data, patients under 18 years old, cardiopulmonary arrest in the ED, and pregnancy (Figure 1).

Statistical Analyses

We performed statistical comparisons using the statistical software package SPSS 25.0 (SPSS Inc., Chicago, IL, USA) and used the Kolmogorov-Smirnov test for normal distribution. For normally distributed variables, we used an unpaired t-test, and for non-normally distributed variables, we used the Mann-Whitney U test. Categorical variables are expressed in frequencies and percentages. We used a chi-square test to compare categorical variables and a paired t-test for continuous variables. Definitive statistics were expressed as mean \pm standard deviation (SD) and median (interquartile range, IQR). We used Pearson's and Spearman's correlation tests for correlations. A p-value < 0.05 was considered significant.

Results

We included 34 (53.9%) men and 29 (46.1%) women for a total of 63 COVID-19 patients in our study. The mean age of our study group was 46.78 ± 18.57 years (min: 18, max: 83) (Table 1).

Fifty-four patients were hospitalized in the inpatient clinic and 9 patients in the ICU. Fifty-nine patients underwent endotracheal intubation. Fifty-nine patients were discharged, and 4 patients died. EWSs were positively correlated with hospitalization length, but we could not find a relationship between qSOFA and hospitalization length. The ICU hospitalization rate increased with high EWSs AND qSOFA scores (Table 2).

The mean EWS of patients hospitalized in the inpatient clinic was 1.39 and that of the patients hospitalized in the ICU was 5.7. These scores were significantly different ($p = 0.000$).

The mean EWS of the patients discharged from the hospital was 1.6 and that of the exitus patients was 11.7 ($p = 0.01$). These values were 0.06 and 2.25 for qSOFA, respectively.

Patients with EWS more than 5 points were hospitalized for more than five days, and when we divided the patient group according to 5 hospitalization days (1. Group: less than 5 days/31 patients, 2: more than 5 days/32 patients), age

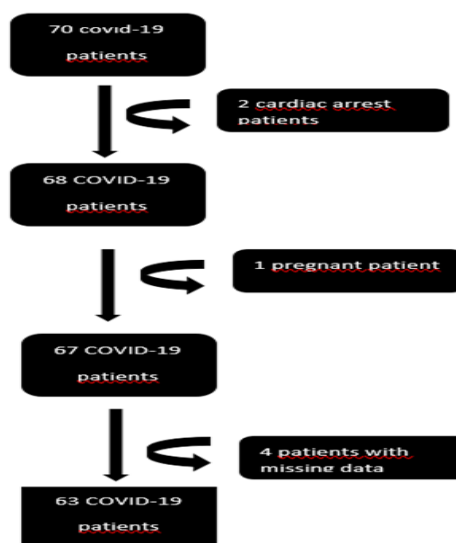


Figure 1. Exclusion criteria flow chart

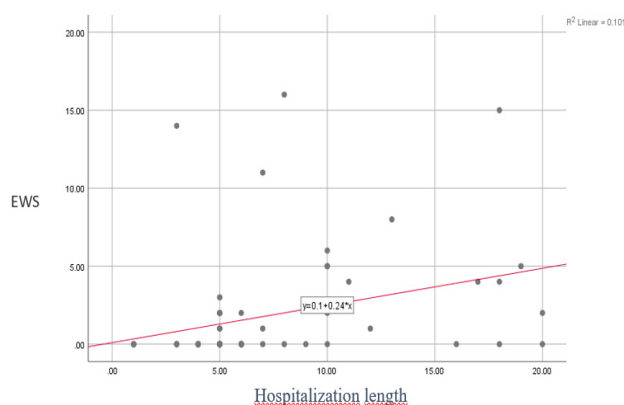


Figure 2. Correlation graph of hospitalization length and EWS

Table 1. Early Warning Score

	3	2	1	0	1	2	3
RR	≤8		9-11	12-20		21-24	≥25
SPO2	≤91	92-93	94-95	≥96			
Suppl. O2 requirement		Yes		No			
Temperature	≤35.0		35.1-36	36.1-38.0	38.1-39.0	≥39.1	
SBP	≤90	91-100	101-110	111-219			≥220
HR	≤40		41-50	51-90	91-110	111-130	≥131
Consciousness				A			VPU

RR: respiratory rate, SBP: Systolic blood pressure, HR: heart rate

Table 2. Correlations between EWS and qSOFA according to ICU hospitalization, hospitalization length, intubation and death

	ICU hosp	Hosp length	Intubation	Ex
EWS	p=0.000 r=0.749	p=0.011 r=0.317	p=0.000 r=0.705	P=0.000 r=0.705
qSOFA	P=0.000 r=0.729	p=0.290 r=0.235	p=0.000 r=0.767	p=0.000 r=0.767

($p=0.00$), and EWS ($p=0.02$) were significantly different in patients hospitalized more than 5 days (independent sample test). qSOFAs were not significantly different ($p=0.221$). Hospitalization length was positively correlated with EWS ($p=0.011$, $r=0.317$) (Figure 2).

Discussion

Suspected COVID-19 patients were present in the ED first and waited for some blood tests and thorax CT to support the diagnosis. After a swab for PCR, the patients were hospitalized in the inpatient COVID clinic or COVID ICU. During this time, the ED management of these patients was not clear enough. A lack of literature means guidelines are required for the ED management of suspected COVID-19 patients. ED clinicians sometimes follow up suspected patients for many hours before hospitalization. The main complaints of these patients are respiratory distress, fever, cough, altered mental state, syncope, etc. According to one case series, hypotension occurred in 17 of 24 critically ill COVID-19 patients who required fluid and rapid vasopressor administration [3].

EWSs and qSOFA have recently been compared for critically ill patients in several studies. According to a large study (8,204 patients), EWSs were superior at predicting mortality. The researchers also compared these scoring systems with SIRS criteria and found that both EWSs and qSOFA were better predictors of mortality than SIRS [4].

Similarly, Usman et al compared qSOFA, EWSs, and SIRS for ED triage of sepsis and septic shock patients. They suggested that the EWS is simply calculated score and the best predictor for mortality and severity [5].

Ambulance triage and scoring systems play an important role in the emergency setting. Ambulance staff members want to know about the severity of the illness as much as an ED doctor. The researchers conducted a pre-hospital-setting study among 1,713 patients to compare EWSs and qSOFA in predicting ICU hospitalization and 30-day mortality. In this study, EWSs were

much more effective at determining these parameters when compared with qSOFA [6].

There is a lack of data in the literature on qSOFA and EWSs for specific infections. Chang et al researched qSOFA for the in-hospital mortality of H1N1 infection in the geriatric population, enrolling 491 H1N1 patients. Patients with qSOFA ≥ 2 increased the in-hospital mortality risk [7].

Determining the severity of COVID-19 remains problematic. A study from China suggested that male gender, older age, and hypertension are the most important risk factors for this severity. The researchers included 487 COVID-19 patients, 49 of whom were critically ill at admission time. According to their data, severe cases mainly comprised older (> 50 years old), hypertensive, and male patients. The researchers concluded that by identifying host risk factors associated with severe COVID-19 cases, their study shed light on the underlying mechanisms of the disease progression. They reported that the host risk score provides a helpful tool to identify high-risk patients, which is useful for performing specific strategies to prevent and treat the disease [8].

It is very important to decide the severity of ED patients without waiting on a blood test or any other imaging studies. Simple scoring systems consisting of vital signs and a patient's status are much more helpful for clinicians. Analyzing 108 COVID-19 patients retrospectively, Yao et al performed research to identify the clinical characteristics and risk factors associated with severe incidences of SARS-CoV-2 infection. According to their data, older age and comorbidities such as hypertension, higher blood leukocyte or neutrophil count, higher sensitive C-reactive protein level, D-dimer level, Acute Physiology and Chronic Health Evaluation II score, and sequential organ failure assessment (SOFA) score were associated with a greater risk of developing severe COVID-19 cases, as were lower lymphocyte count and albumin level [9].

Rapid and early severity assessment is the main decisive factor for critically ill patients with COVID-19 in the ED. Initial evaluation and treatment strategy are planned according to these scoring systems. Hu et al compared the Modified Early Warning Score (MEWS) and the Rapid Emergency Medicine Score (REMS) according to their outcomes in 138 critically ill COVID-19 patients. They divided patients into two age subgroups (< 65 and ≥ 65 years) and reported that the REMS could provide a much more effective risk stratification tool for critically ill patients with COVID-19, especially for those aged < 65 years. The effectiveness of REMS for screening these patients is attributed to its high negative predictive value [10].

Limitations

Most members of the patient group were in good condition, and similarly most were hospitalized in the inpatient clinic rather than in the ICU. This situation made it difficult to study critically ill COVID-19 patients.

Conclusion

EDs are the places where the suspicious COVID-19 patients present first, and the ED physicians are responsible for providing effective care during these patients' stay. Tools are required to predict the severity and prognosis, especially for critically ill COVID-19 patients. Both qSOFA and EWS can predict the hospitalization unit and mortality. But EWS is superior in determining the hospitalization length of COVID-19 patients. At this point, further comprehensive studies are required for the management of suspected or validated COVID-19 patients in the ED.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016;315(8): 801-10.
2. Bora ES, Çakır A, Hacar S, Arikani C, Yurtsever G, Acar H. Nonthyroid disease syndrome: a strong prognostic predictor of death in patients with pneumonia. *Signa Vitae*. 2021;17(5):137-41.
3. Bhatraju PK, Ghassemieh BJ, Nichols M, Kim R, Jerome KR, Nalla AK, et al. Covid-19 in Critically Ill Patients in the Seattle Region - Case Series. *N Engl J Med*. 2020;382(21): 2012-22.
4. Brink A, Alisma J, Verdonschot RJCG, Rood PPM, Zietse R, Lingsma HF, et al. Predicting mortality in patients with suspected sepsis at the Emergency Department; A retrospective cohort study comparing qSOFA, SIRS and National Early Warning Score. *PLoS One*. 2019;14(1):e0211133.
5. Usman OA, Usman AA, Ward MA. Comparison of SIRS, qSOFA, and NEWS for the early identification of sepsis in the Emergency Department. *Am J Emerg Med*. 2019; 37(8): 1490-7.
6. Silcock DJ, Corfield AR, Staines H, Rooney KD. Superior performance of National Early Warning Score compared with quick Sepsis-related Organ Failure Assessment Score in predicting adverse outcomes: a retrospective observational study of patients in the prehospital setting. *Eur J Emerg Med*. 2019;26(6):433-9.
7. Chang SH, Yeh CC, Chen YA, Hsu CC, Chen JH, Chen WL, et al. Quick-SOFA score to predict mortality among geriatric patients with influenza in the emergency department. *Medicine (Baltimore)*. 2019;98(23):e15966.
8. Shi Y, Yu X, Zhao H, Wang H, Zhao R, Sheng J. Host susceptibility to severe COVID-19 and establishment of a host risk score: findings of 487 cases outside Wuhan. *Crit Care*. 2020;24(1):108.
9. Yao Q, Wang P, Wang X, Qie G, Meng M, Tong X, et al. A retrospective study of risk factors for severe acute respiratory syndrome coronavirus 2 infections in hospitalized adult patients. *Pol Arch Intern Med*. 2020;130(5):390-9.
10. Hu H, Yao N, Qiu Y. Comparing Rapid Scoring Systems in Mortality Prediction of Critically Ill Patients With Novel Coronavirus Disease. *Acad Emerg Med*. 2020;27(6):461-8.

How to cite this article:

Mehmet Tunç, Kemal Sener, Nurettin Yılmaz, Tufan Nayir, Sadiye Yolcu. Early warning score versus quick sequential organ failure assessment in COVID-19. *Ann Clin Anal Med* 2022;13(6):659-662