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Research Article

Prognostic Accuracy of the Quick Sequential Organ Failure Assessment Score and National Early Warning Scores in Mortality Rate of the Non-Traumatic Patients

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ABSTRACT

Background: The current study aimed to evaluate the predictive value of mortality in patients admitted to the Intensive Care Unit (ICU) through the emergency department and based on Quick Sequential Organ Failure Assessment (qSOFA), National Early Warning Score (NEWS) and NEWS2 criteria.

Methods: In this cross-sectional study, all patients referred to the emergency department with a need of admission to ICU for any reason, were evaluated. Demographic data such as age and sex were recorded for data collection. Also, the main diagnosis, length of stay and hospitalization outcome along with data related to qSOFA, NEWS and NEWS2 indices were included in the researcher's checklist.

Results: Of 89 included patients, 52 (58.4%) were male and 37 (41.6%) were female, with mean age of 60.25±20.8. Our findings indicated that qSOFA is a good predictor for mortality in non-traumatic patients so that qSOFA has 48% sensitivity and 100% specificity in the diagnosis of mortality in non-trauma patients. NEWS also has a sensitivity of 72% and a specificity of 71.4% in the diagnosis of non-traumatic mortality. And NEWS2 has 72% sensitivity and 78.6% specificity in non-traumatic mortality diagnosis.

Conclusion: Our findings suggested that the sensitivity and specificity of qSOFA, NEWS and NEWS2 in predicting the mortality of non-traumatic patients who were admitted in emergency departments and hospitalized in ICU, are high and reliablen.

The use of Early Warning Scoring (EWS) system, known as physiological, weight tracking and famous trigger systems, has been recommended in a wide range of UK reports on early detection and response to worsening disease. These systems are widely based on deviations from the variables of patients' vital symptoms (e.g. pulse rate, respiratory rate, blood pressure) from "normal" ranges [1-3]. Vital signs are scored based on the EWS System, which is assumed to be deviations from normal assumptions. Therefore, they are now recommended for daily use in UK hospitals. In 2012, the Royal College of Physicians of London (RCPL) introduced and published the National Early Warning Score (NEWS), which is now widely accepted [4-7].

The significance of the EWS to both pre-hospital emergency teams and hospital physicians is still unknown [8]. We assume that the data from pre-hospital observations depends on the gradual increase in critical care or death within 48 hours of hospitalization, and in addition, the NEWS derived from pre-hospital

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observations largely depends on measuring the outcome of NEWS at hospital admission [9-10].

Quick Sequential Organ Failure Assessment (qSOFA) has been extracted and validated along with the release of the third internationally agreed definition for sepsis and septic shock (sepsis 3). It was suggested in the large clinical dataset to help physicians detecting the patients with sepsis among the ones suspected to infection. This scoring system consists of three easy-to-measure clinical parameters including Glasgow Coma Scale (GCS), systolic blood pressure and respiratory rate. qSOFA showed higher predictive validity for in-hospital mortality due to infection (out of the ICU) compared to systemic inflammatory response syndrome (SIRS) [11-13].

This study aimed to evaluate the predictive value of mortality in patients admitted to ICU through the emergency department and based on qSOFA, NEWS and NEWS2 criteria.

Methods

After the ethical approval of the Ethics Committee of Tabriz University of Medical Sciences and considering the inclusion and exclusion criteria, a descriptive analytical cross-sectional study was conducted at Sina Teaching Hospital during 2019. This study evaluated all patients who were admitted to ICU through the emergency department for any reason such as the need for positive ventilation or the need for monitoring and care. Patients who were needed to be admitted to ICU because of trauma or accidents or who were left the hospital with personal consent in the process of treatment for any reason were excluded from the study. Demographic data such as age and sex were recorded for data collection. Also, the main diagnosis, length of stay, and outcome of hospitalization along with data related to qSOFA, NEWS and NEWS2 indices were included in the researcher's checklist.

Inclusion criteria: Referring to Emergency Department of Sina Teaching Hospital, Admission to ICU of Sina Hospital, Informed consent to participate in the study

Exclusion criteria: Hospitalization in ICU due to trauma or accidents, Leaving the hospital with personal consent, The incomplete information in the file.

The statistical software used in the study was IBM SPSS Statistics software (version 25; SPSS, Chicago, IL). Absolute and relative frequencies were used to describe the qualitative variables, and standard deviation and mean were used for describing quantitative variables. We found the best measure for cut-off point from the upper left corner of the receiver operating characteristic curve (ROC), which was plotted on the basis of the results of each index. The binary logistic regression model was applied to find the relationship between the findings of each index and mortality. Specificity and Sensitivity were calculated for each index, separately. Significance level of P-value was considered to be less than 0.05.

Results

Of 89 patients included in the study, 52 (58.4%) were male and 37 (41.6%) were female. The mean age of patients was 60.25±20.8 (5-96) years. Of the 89 participants, 14 (15.7%) died. Regarding the demographics of the deceased patients, 64.3% were male with an average age of 76 (34-86) years and (Table 1).

The mean qSOFA score for the 89 patients was 1.51±0.81 in the range of 0 to 3. Also, the findings of the ROC Figure (Figure 1) showed that qSOFA was a good predictor of mortality in non-traumatic patients (Area = 0.740, P-value> 0.05) so that qSOFA has 48% sensitivity and 100% specificity in the diagnosis of non-traumatic mortality.

Among the patients studied, 14 patients died and qSOFA was 2≤ for all of them. Thus, the positive predictive value of qSOFA in mortality diagnosis of non-traumatic patients was 100%.

In this study, 75 survived, but the qSOFA score was ≤ 2 for 39 alive patients. Thus, the negative predictive value of qSOFA in the diagnosis of non-traumatic mortality was 26.4%.

The mean NEWS score for the 89 patients studied was 8.44±4.3 in the range of 0 to 17. Also, the findings of the ROC Figure (Figure 2) showed that NEWS is a good predictor of mortality in non-traumatic patients (Area = 0.717, P-value> 0.5. NEWS has a sensitivity of 72% and a specificity of 71.4% in the diagnosis of non-traumatic mortality.

In this study, 14 patients died, but the NEWS score was≤ 11 for 10 of them. Thus, the positive predictive value of NEWS in non-traumatic mortality was 93.1%. In this study, 75 survived, but the NEWS score for 21 of them was ≤ 11. Thus, the negative predictive value of NEWS in non-traumatic mortality was 32.3%.

The mean NEWS2 score for the 89 patients studied was 8.62±4.3 in the range of 0 to 17. Also, the findings of the ROC Figure (Figure 3) showed that NEWS2 is a good predictor of mortality in non-traumatic patients (Area = 0.801, P-value> 0.05). NEWS2 has 72% sensitivity and 78.6% specificity in non-traumatic mortality.

Evaluating the Positive and Negative Predictive Value of the NEWS2 Index in Predicting Mortality of Non-Trauma Patients Admitted to Intensive Care. 14 patients died, but the NEWS2 score was ≤ 11 for 11 of dead patients. Thus, the positive predictive value of NEWS2 in the diagnosis of non-traumatic mortality was 94.7%. In this study, 75 patients survived, but the NEWS2 score for 21 of alive patients was ≤ 11. Thus, the negative predictive value of NEWS2 in non-traumatic mortality was 34.4%.

Table 1- Frequency and percentage of mortality in studied patients

	age	gender	
	Mean (minimum-maximum)	**male Frequency (%)**	**female Frequency (%)**
Dead patients (14 people)	76 (34-86)	9 (64.3%)	5 (35.7%)
Alive patients (75 people)	66 (5-90)	43 (57.3%)	32 (42.7%)

Figure 1

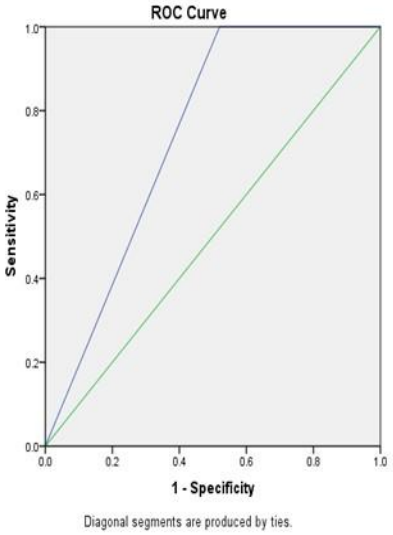


Figure 2

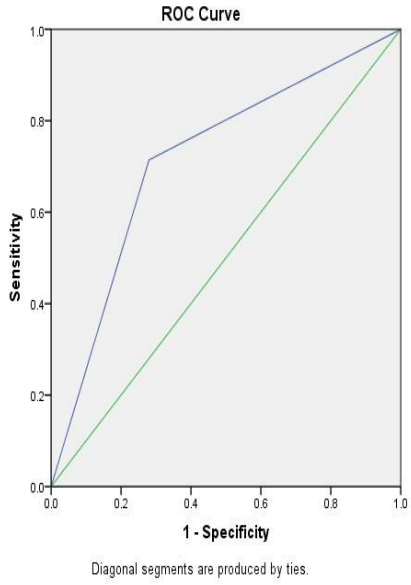
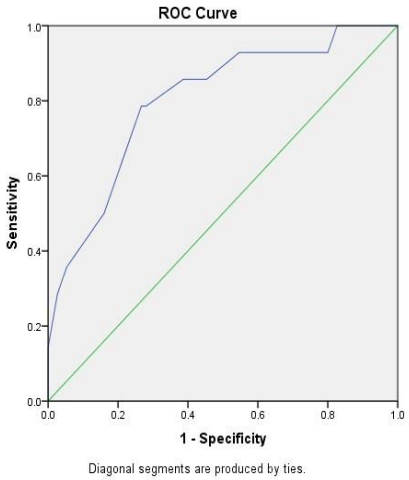


Figure 3



Discussion

EWS have been increasingly used throughout the world in recent years as a means of identifying possible deterioration. However, these results are effective in reducing adverse outcomes if appropriate clinical response is available to those with experience in the care process, so that it can provide the best feedback in response to the changing clinical situation.

Scores recorded for a patient population or health care system may not be applicable to other populations or other health care systems [14] and even in a health care system there may be people who do not act the same in recording the standard points and triggers. It may be necessary for some groups of patients with chronic life-threatening symptoms to make the necessary changes to different parts of the checklist. The use of general scoring systems such as NEWS is increasing today. This system plays an important role in predicting the need for hospital admission as well as predicting the possible outcomes, especially in sepsis [15]. Special patients require more urgent care [16]. In a particular sample of patients suspected of sepsis, timely use of antibiotics can make a significant difference in outcome. This may be part of the alert protocol [17]. If the NEWS score is low, as well as appropriate clinical evaluation, the patient may safely perform treatment in a place other than the emergency department.

In Daniel J. Silcock et al. Study, which was conducted specifically in UK in 2015, overall assessment of a wide range of patient evaluations showed that patients with NEWS scores of 7 or higher, were 11% likely to die or be admitted to intensive care units within 48 hours [5]. Although the risk is still low, there is a statistically significant increase in the intensive care unit in the intermediate risk group, and the scoring shows good sensitivity to adverse outcomes. While the use of NEWS

should not replace clinical judgment and natural scoring should not prevent serious pathology, unexpected high scores should increase priorities.

According to our findings in this study, NEWS has a sensitivity of 72% and a specificity of 71.4% in diagnosis of non-traumatic mortality. The positive predictive value of NEWS in non-traumatic mortality was 93.1% and the negative predictive value of NEWS in non-traumatic mortality was 32.3%.

Post-analysis findings indicated that NEWS2 is a good predictor of mortality in non-traumatic patients (Area = 0.801, P-value> 0.05). NEWS2 has 72% sensitivity and 78.6% specificity in non-traumatic mortality.

The positive predictive value of NEWS2 in non-traumatic mortality was 94.7%, and the negative predictive value of NEWS2 in non-traumatic mortality was 34.4%.

In Singer M et al study conducted in emergency departments of four European countries, qSOFA had a more accurate prognosis for hospital mortality than SIRS or severe sepsis. In most of other retrospective studies conducted in emergency departments, SOFA was associated with hospital mortality with a high specificity and a low sensitivity to predict mortality [18].

But in our study, our findings showed that qSOFA was a good predictor of mortality in non-traumatic patients (Area = 0.740, P-value> .05). QSOFA has 48% sensitivity and 100% specificity in the diagnosis of non-traumatic mortality. Positive predictive value of qSOFA in mortality diagnosis of non-traumatic patients was 100%, and the negative predictive value of qSOFA in the diagnosis of non-traumatic mortality was 26.4%.

Overall, the ample evidence from a large number of studies suggests that qSOFA may be a useful triage criterion for the rapid diagnosis of sepsis patients in emergency departments. Given that it consists of three clinical parameters, can be evaluated quickly and easily in the bed. It is a very useful tool used in emergency departments in low-income countries with limited resources, however, its function in these areas is unknown and requires further studies in triage [6, 19].

The purpose of the Blanco study is to evaluate the accuracy of qSOFA prognosis for 28-day mortality in patients with post-treatment fever in emergency departments of Dar es Salaam, Tanzania and its comparison with SOFA and SIRS [16]. The findings of this study are in line with the results of the present study.

Conclusion

Our findings indicated that qSOFA is a good predictor of mortality in non-traumatic patients, so that qSOFA has 48% sensitivity and 100% specificity in mortality diagnosis of non-traumatic patients. NEWS also has a sensitivity of 72% and a specificity of 71.4% in the diagnosis of non-traumatic mortality. We also didn't find any significant differences between the sensitivity and the specificity of NEWS and NEWS2.

Acknowledgments

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Ethical approval

Ethics approval was obtained from the Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1398.726). All procedures performed in this study were approved. Written informed consent was obtained from all participants.

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