Battle of Being Better! Comparison of NEWS vs qSOFA in the Early Detection of Sepsis in Emergency Department

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ABSTRACT

Objective: Our objective is to study the relationship between NEWS & qSOFA at presentation and the diagnosis of severe sepsis and septic shock in the Emergency Department (ED).

Study Design: A prospective observational study

Place and Duration of Study: This study was conducted at the Emergency Department of Mayo Hospital Lahore from Oct.2023 to Jan.2024.

Methods: A prospective observational study was designed with the target population including patients presenting with clinical signs and symptoms suggestive of sepsis in the ED of our tertiary care hospital. Both NEWS and qSOFA scores were calculated in the diseased population. The indices like specificity, sensitivity and area under the ROC curve of both scores were compared.

Results: We included 94 patients in our study, out of which 53 were males and females were 41, were screened for sepsis using NEWS and qSOFA. NEWS was discovered to perform marginally better than qSOFA. The sensitivity of NEWS and qSOFA were found to be 90.91% and 87.72%, specificity was 85.71% and 67.57% and area under ROC curve was 0.94 and 0.794, respectively.

Conclusion: NEWS was found to be more sensitive than qSOFA in the sepsis identification in the emergency department. A score of 5 or more can be used as a reliable indicator for sepsis screening.

Key Words: SIRS, qSOFA, National Early Warning Score, Emergency Department

INTRODUCTION

Around the globe, Sepsis remains one of the leading causes of morbidity as well as mortality, with a case fatality rate of up to 30%, rising to 70% for septic shock. Delayed identification and management of septic shock significantly increase mortality risk in a time-dependent manner[1]. Sepsis results from the body's response to infection, where the infectious agent and host-generated inflammatory response overwhelm regulatory mechanisms, disrupting homeostasis[2]. The Society of Critical Care Medicine and the American College of Chest Physician, in 1992, issued a consensus statement to set common standards for sepsis syndromes.

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An established nomenclature is essential for categorizing diseases and facilitating systematic comparisons across studies[3]. The term SIRS (systemic inflammatory response syndrome) is defined as two or more of the following: heart rate > 90 bpm, respiratory rate> 20 breaths / min, temperature over 38 °C or below 36 °C and white blood cell count above 1200 or below 4000 / mm^3 along with 10% bandemia. The presence of infection along with SIRS is termed as sepsis. If the patient develops organ dysfunction along with the above mentioned, it is severe sepsis and finally septic shock is coined sepsis with hypotension[4]. This nomenclature attempts to provide researchers and physicians with a common classification. During the efforts of formulation, a valid system of nomenclature have divulge that the term sepsis, when exclusively defined by the SIRS criteria, the results get abnormally sensitive and non-specific, failing to estimate an enhanced mortality or organ dysfunction risk[5]. Moreover, SIRS is increased in localized infections that are not likely to progress to sepsis and even in non-infectious inflammatory disorders, revealing its non-specific nature rendering it difficult to be used solely as a diagnostic criteria [6, 7].

Singer et al. in 2016 during The Third International Consensus Definitions for Sepsis (Sepsis-3) agreed on sepsis definition as a dysregulated host response to

infection leading to life threatening organ dysfunction[4]. This new definition does not rely on inflammation or its response (SIRS), nevertheless, it is dependent on a new score, Sequential (Sepsis-related) Organ Failure Assessment (SOFA) as the assessment basis of organ dysfunction and sepsis[5]. As SOFA score is usually not employed outside the intensive care settings, and it requires laboratory values, which are not readily available, Quick (q) SOFA score is suggested as a stand-in metric that might help patients with known or suspected infections forecasting their risk of developing sepsis. Additionally, physicians might consider the diagnosis of sepsis due to its prompt availability and easy calculation[6-8]. The qSOFA score uses three parameters, with one point for each them: respiratory rate $\geq$ 22 per minute, alterations in the mental status (GCS <14), and hypotension (SBP of 90 mmHg or less). A score of two or above was also associated with an enhanced risk of mortality [8].

Sepsis is a graded reaction over time, not an incidental phenomenon. The scoring methods that include a scaled response appear to be better predictors or have a greater diagnostic yield than those that merely allow for a response that is either yes or no (9). The National Early Warning Score (NEWS) incorporates seven parameters: respiratory rate, systolic blood pressure, oxygen saturation, heart rate, supplemental oxygen need, altered sensorium, and assigning numerical values based on deviation from normal ranges. Unlike qSOFA, NEWS includes an intermediate risk category for additional risk assessment and has demonstrated superior efficacy in sepsis detection across multiple studies[10]. The NEWS is a tested tool for the detection of clinical deterioration and can be used on all hospitalized patients, for the potential need for an escalation to an advanced level of care[11,12].

Keeping in view the diagnostic complexities of sepsis, emergency departments require tools capable of identifying severe sepsis and septic shock promptly, ideally at triage or within ED limitations. This approach minimizes ED length of stay, facilitates earlier disposition decisions, and optimizes resource utilization in resource-limited settings. In our study, we have compared the diagnostic efficacy of NEWS and evaluated its performance against qSOFA.

METHODS

We conducted a prospective cohort study on patients with clinical suspicion of sepsis presenting to the Emergency Department of Mayo Hospital Lahore from Oct.2023 to Jan.2024. Probability random sampling technique was used. Formal consent was taken from the participants and Institutional Review Board (IRB) approved the study.

Our criteria included patients over 14 years old with SIRS and signs of infection. Severe Sepsis was defined as two or more SIRS criteria plus suspected infection

and specific indicators: lactic acid > 2.0 mmol/L, SBP < 90 mmHg, MAP < 65 mmHg, creatinine > 0.5 mg/dL above baseline, platelets < 100x10^9/L, or total bilirubin > 2 mg/dL (not previously baseline). Septic Shock was defined as severe sepsis plus persistent hypotension (SBP < 90 mmHg or MAP < 65 mmHg after a one-liter crystalloid fluid challenge), lactic acid > 3.9 mmol/L, or need for vasopressors within eight hours of ED arrival.

The study excluded patients with a history of hospital admission within the previous two weeks, immunocompromised, taking immunosuppressive drugs, active cancer treatment, and recent organ transplants.

The endpoint of the study was a diagnosis of severe sepsis and septic shock within eight hours of the emergency presentation. The attending emergency team labelled the patients as having severe sepsis or septic shock. The vitals, NEWS & qSOFA scores were recorded at triage or by first responder in the ED, then severe sepsis or septic shock was labelled after 4-8 hours of management or on reassessment. Statistical analysis was done using SPSS 20. A sample size of 91 patients was calculated by taking a confidence interval of 95%, absolute precision of 10%, and the expected percentage of area under the curve for qSOFA as 81% and NEWS as 91%[15].

RESULTS

We evaluated 94 patients from October to January who had a suspicion of sepsis. In our study, 53 patients (56.4%) were male and 41 (43.6%) were female. The mean age of our sample population was 50.32± 17.25 years old. The frequency of the study variables is shown in table 1.1&1.2
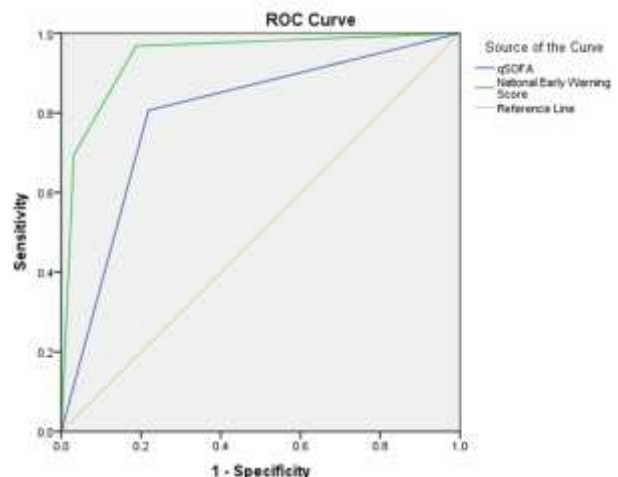

Figure No. 1: ROC Curve of qSOFA & NEWS for Sepsis Identification

Table No. 1.1: Frequency of the Study Variables of NEWS

Variable		Frequency	(%)
Systolic Blood Pressure (mmHg)	101-110	10	10.6
	91-100	9	9.6
	<90	45	47.9
Respiratory Rate	21-24	31	33
	>25	31	33
Supplemental Oxygen Requirement FiO$_2$ (>21%)		31	33
Altered Sensorium (VPU)		28	29.8
Heart Rate	91-110	25	26.6
	111-130	42	44.7
	>131	20	21.3
Temperature	38.1 ^{0}C -39 ^{0}C	23	24.5
	>39 ^{0}C	2	2.1
Oxygen Saturation	94%-95%	21	22.3
	92%-93%	4	4.3
	<91%	27	28.7
NEWS Score	Low Risk (0-4)	28	29.8
	Moderate Risk(5-6)	22	23.4
	High Risk (7+)	44	46.8

Table No. 1.2: Frequency of the Study Variables of qSOFA

Variable		Frequency	Percentage (%)
Systolic Blood Pressure (SBP) <90mmHg		57	60.6
GCS <14		35	37.2
Respiratory Rate >22		64	68.1
qSOFA Score	Low Risk (Score 0-1)	37	39.4
	High Risk (Score >2)	57	60.6

A total of 62 patients were later diagnosed with severe sepsis and septic shock. The validity of NEWS and qSOFA in the diagnosis is given in Table 2.

Table No. 2: Association of NEWS & qSOFA in Sepsis Diagnosis

Variable		Frequency	Severe Sepsis/ Septic Shock Diagnosed
NEWS	Low Risk	28	2
	Moderate Risk	22	17
	High Risk	44	43
qSOFA	Low Risk	37	12
	High Risk	57	50
p-Value			0.001

Taking a 95% confidence interval, NEWS $\geq$ 5 and qSOFA score $\geq$ 2, sensitivity, specificity and area under ROC curve (AUROC) are calculated for their sepsis prediction, as given in Table 3 & figure 1.

Table No. 3: Validity of NEWS & qSOFA Score in Sepsis Prediction

Variable	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Area under curve
NEWS	90.91% (81.26% to 96.59%)	85.71% (67.33% to 95.97%)	93.75% (85.78% to 97.39%)	80% (64.76% to 89.70%)	0.940 (0.886 to 0.994)
qSOFA	87.72% (76.32% to 94.92%)	67.57% (50.21% to 81.99%)	80.65% (72.15% to 87.01%)	78.12% (63.28% to 88.10%)	0.794 (0.693 to 0.895)

DISCUSSION

Patient triage strategies form the fundamental cornerstone of Emergency Medicine, which dates back to the 18th century, involves the evaluation of a patient by a qualified individual to prioritize them based on the severity of their illness[14].

The burden of sepsis is undoubtedly on the rise, and there are several factors responsible for this alarming trend[4]. It is associated with significant mortality, with 1 in 5 deaths worldwide due to sepsis and the survivors may face lifelong consequences[6]. It is crucial to effectively triage sepsis to ensure prompt recognition and the necessary interventions, in full accordance with the Sepsis-3 guidelines[8]. In our study, we have emphasized the detection of severe sepsis and septic shock at the triage or first responder in the emergency department. Using the physiological parameters of NEWS and qSOFA, we can accurately screen the patients for the presence of sepsis (p-value =0.001). We found NEWS to be a better predictor of early detection of sepsis than qSOFA having an area under the receiver operating characteristic curve (AUROC) to be 0.94 compared to 0.79 of qSOFA.

The holistic approach of using scoring systems in the ED is to increase the clinical judgment of sepsis and provoke physicians to perform emergent interventions at the earliest[16]. Subsequently, scoring frameworks utilized within the ED must have a low enough limit to play down lost cases of sepsis. Many of the previous studies done did show qSOFA favours specificity over sensitivity, but in our study when we used the scores on

the same patients, NEWS was found to be not only more sensitive but also more specific than qSOFA. The main reason qSOFA may fall flat to attain high sensitivity is due to the exclusion of imperative physiologic parameters like heart rate and temperature which are usually the forerunners of clinical deterioration. As a result, qSOFA might be better suited for screening at later stages when organ dysfunction is already present and treatment decisions are imminent[15-18].

Taking into consideration the AUROC curve, which comes out to be 0.94 for NEWS than 0.79 for qSOFA, which may be due to the inclusion of multiple factors like oxygenation, and tachycardia which reliably predict the end-organ dysfunction. Our findings indicate that table-based aggregate weighted systems, particularly NEWS, are significantly more predictive and robust in comparison to tally-based single parameter scores like qSOFA and SIRS. This is most likely due to the presence of multiple cutoff points, bi-directional scoring (with points awarded for both hypothermia and fever), and the ability to capture non-linear relationships[13].

In the study conducted by Churpek et al., early warning scores were found to be more sensitive in predicting mortality and ICU admission in septic patients. Results comparable to ours were found in the study carried out by Brink et al [19]. Usman et al.[13] conducted a study in the Asian population comparing NEWS, qSOFA, and SIRS for the diagnosis of sepsis in the emergency department, suggesting NEWS unequivocally superior to both the other scores. Keep et al.[10], studied the same parameters and found similar results. In a contemporary study by Oduncu et al., sensitivity of NEWS and qSOFA was discovered to be almost comparable [21].

In our study, diagnosis of severe sepsis and septic shock in maximum of eight hours of ED presentation was the primary endpoint. Early diagnosis and prompt interventions have been shown to provide a significant mortality benefit to the population. Once the diagnostic dilemma is crossed, clinicians find it easier to initiate goal-directed therapy to treat sepsis, emphasizing early administration of antibiotics, source control, and hemodynamic optimization.

CONCLUSION

Our study concluded that the National Early Warning Score (NEWS) is a more accurate and reliable diagnostic tool for sepsis in the Emergency Department compared to qSOFA. As both scores can be calculated at the triage or first responder, NEWS allows for a better prediction of the disease severity and risk assessment, which is vital for the timely management of sepsis

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