WHICH RATING SYSTEM IS BETTER – QSOFA OR SIRS?

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ABSTRACT

INTRODUCTION: The definitions of sepsis and septic shock were redefined in 2016. This study compares the performance of qSOFA with that of SIRS criteria for the diagnosis of sepsis and prediction of 30-day mortality.

AIM: The aim of this article is to assess the severity of the infection of patients using SIRS and qSOFA scales and to compare their specificity and predictive value.

MATERIALS AND METHODS: A prospective, non-interventional single-center clinical trial was conducted at St. Marina University Hospital in Varna. The sample included 87 patients with sepsis and septic shock. The criteria for inclusion in the study were laboratory constellation for systemic exposure; over 18 years of age; with or without co-morbidities; no malignancies. Pregnancy, neoplasia and the age of under 18 were the criteria for exclusion. Logistic regression was used to test the predictability of both scales. ROC curve analysis determined the sensitivity and specificity of SIRS and qSOFA.

RESULTS: Our analysis showed that both SIRS and qSOFA are significant predictors of mortality of septic patients. The SIRS scale had a 2.050-fold probability of predicting the death of the patient (p=0.004, 95% CI 1.255 - 3.349), whereas the qSOFA score was 2.581 times more likely to predict mortality in patients with sepsis and septic shock (p=0.0001, 95% CI 1.557 - 4.279). Cut-off values for SIRS higher than 2.5 points showed 91% sensitivity and 60% specificity - (AUC 0.80, 95% CI - 0.712 - 0.907), whereas qSOFA scores greater than 1.5 points indicated sensitivity of 82.2% and specificity of 70.3% (AUC 0.85, 95% CI 0 0.770 - 0.934).

CONCLUSION: SIRS and qSOFA criteria for early detection of sepsis are useful clinical tools for mortality reduction and predictability.

Keywords: *SIRS, qSOFA, infection, sepsis, mortality, predictability*

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INTRODUCTION

Sepsis is among the leading causes of critical illness and mortality worldwide. New definitions of sepsis and septic shock were suggested in 2016. The previous consensus definitions of sepsis required an infection and two or more systemic inflammatory response syndrome (SIRS) criteria (1,2). SIRS criteria were defined as: fever or hypothermia (body temperature > 38 °C or < 36 °C, respectively), leukopenia or leukocytosis (leucocyte count > 12,000 cells/μL or < 4000/μL), tachypnea (respiratory rate > 20 breaths per minute), and tachycardia (heart rate > 90 beats per minute) (3,4).

According to the Third International Consensus Definitions for Sepsis and Septic Shock (SEPSIS-3), sepsis is defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection. This new definition emphasizes the primacy of the nonhomeostatic host response to infection, the potential lethality, and the need for urgent recognition. Organ dysfunction can be identified as an acute change in the total SOFA score ≥2 points consequent to the infection (5). According to SEPSIS-3, septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality.

An increase in the Sequential Organ Failure Assessment score (SOFA) greater or equal to 2 is associated with an in-hospital mortality greater than 10% (5,6). Higher SOFA scores are associated with increased probability of mortality. As a bedside screening tool for sepsis-related mortality for non-intensive care settings, quick SOFA (qSOFA) score is introduced to rapidly identify patients with high risk of sepsis-related mortality.

Recent debates in medicine are related to which rating system is better for sepsis diagnosis: qSOFA or SIRS. Are qSOFA criteria better than the SIRS criteria for identifying critically ill septic patients and predicting mortality? Are qSOFA criteria more specific for identifying patients requiring greater level of care?

Accurate diagnosis and early recognition of sepsis are crucial for the effective management of patients, as this improves outcomes. However, both the risk stratification in patients with acute infections and the identification of sepsis are still challenging clinicians (2,7,8,9,10).

The current study compares the performance of qSOFA with that of SIRS criteria for diagnosing sepsis and predicting 30-day mortality.

AIM

The main goal of the study is to assess the severity of the infection of patients using SIRS and qSOFA scales and to compare their specificity and predictive value with respect to septic patient detection, hospital stay, and mortality with follow-up up to day 30.

MATERIALS AND METHODS

A prospective, non-interventional single-center clinical trial was conducted at St. Marina University Hospital in Varna. Patients were recruited from the Intensive Care Department of the hospital and were enrolled after signing a written consent form. The study was performed from January 2017 to July 2018, with the approval of the Ethics Committee of the Clinical Trials at the Medical University – Varna.

The follow-up included 82 patients (50 men, 32 women) at a mean age of 63.7 ± 13.6 years. Of these, about 37 participants were at a mean age of 66.2 ± 10.5 (22 men and 12 women) with infections but no criteria for sepsis (assigned as group I). The remaining patients with sepsis criteria were 45 in total. The patients with sepsis without septic shock (n=26) were assigned to group II and had a mean age of 61.3±15.0 (16 men and 10 women). Patients with septic shock were included in group III (n=19) and had a mean age of 62.2±17.3 (12 males and 7 females).

The criteria for inclusion in the study were laboratory constellation for systemic exposure; over 18 years of age; with or without co-morbidities; no malignancies. Pregnancy, neoplasia and the age of 18 and below were the criteria for exclusion.

The study included different clinical methods for patients' assessment. These encompassed: A) a physical check with focus on mental health status, respiratory and cardiovascular status. Respiratory rate, blood pressure and other vital signs were recorded at the first examination.; B) Blood sample examination, including peripheral blood count, was conducted with the main hematomorphological parameters considered being hemoglobin, erythrocytes, leukocytes with DCC, and platelets. Blood was analyzed

until the first hour with an ADVIA 2120i hematology analyzer; biochemical parameters were also tested: blood sugar, urea, creatinine, sodium, potassium, chlorides, AST, ALT, bilirubin - total and direct, C-reactive protein, total protein and albumin were examined in the venous blood on ADVIA 1800 and OLYMPUS AU 400; coagulation parameters - fibrinogen, D dimers, prothrombin time, aPTT, were examined by venous blood on SYSMEX 1500 and ACL TOP 500 apparatus. Finally, samples for acid-base profile with lactate were tested on a cassette blood gas analyzer GEM Premier 3000 (Instrumentation Laboratory, USA).

We also examined patients by using the qSOFA, SIRS, and SOFA scales. All patients with infections were initially evaluated with qSOFA and SIRS scales. We aimed to differentiate and quickly evaluate patients with severe infections and suspected septic status so that we could start early sepsis therapy. After obtaining the laboratory results, the full SOFA score was calculated, after which we categorically differentiated the three groups in the study (i.e. group I, II, and III). The score was calculated according to generally accepted criteria used in an online calculator accessed at: https://www.mdcalc.com/sequential-organ-failure-assessment-sofa-score.

Each patient with infections and SOFA score ≥2 points or having a 2-point change and a history of prior organ dysfunction was considered septic, as recommended by the Sepsis Working Group (SEPSIS-3, 2016). As septic patients without shock were considered those patients who had data on inflammation and new organ failure rated with SOFA ≥2 points.

Patients with septic shock were grouped as those with infections who had SOFA score of ≥2 points and had serum lactate levels above 2 mmol/L, hypotension, and/or a need for vasopressor therapy that maintained systolic blood pressure of at least 65 mmHg in the absence of hypovolemia.

Receiver operating characteristic (ROC) analyses and logistic regression models assessed whether SIRS and qSOFA scores could indicate the probability for mortality in patients with sepsis and septic shock. Independent t-test was used to assess the differences in the hospital stay of sepsis and septic shock patients. We used IBM SPSS v.24. to analyze the collected data.

RESULTS

Out of all patients who participated in the study, 11 (13.4%) scored 1 point according to SIRS criteria, and 15 patients (18.3%) scored 2 points. The two largest shares included patients with 3 points (24 patients (29.3%)) and 4 points (32 patients (39%)) (Table 1).

Table 1. Patients' characteristics

SIRS (Score)	Patients with Non-Sepsis Infections	Sepsis/Septic Shock Patients Rated with SOFA	Total Number of Patients (%)
1	11	0	11 (13.4%)
2	11	4	15 (18.3%)
3	9	15	24 (29.3%)
4	6	26	32 (39.0%)
Total	37	45	82 (100 %)

Table 2. Sepsis and septic shock patients rated by qSOFA scale

qSOFA	Patients with Non-Sepsis Infections	Sepsis/Septic Shock Patients Rated with qSOFA	Total Number of Patients	Sepsis Patients (%)
0	15	0	15	18.3
1	11	8	19	23.1
2	9	14	23	28.0
3	2	23	25	30.5
Total	37	45	82	100.0

Among the patients with 3 and 4 points according to SIRS, those with sepsis and septic shock predominated (n=41 (91.1%)), while patients with 1 and 2 points according to SIRS scale were mostly patients with non-sepsis infections. Only 4 of the septic patients received 2 points according to the SIRS criteria (n=4, (8.8%)).

Our analysis showed that patients without sepsis were those with qSOFA score of 0 and 1 points, while those with sepsis and septic shock had 2 or 3 points each. Only 8 septic patients received 1 point on the qSOFA scale. Most of the septic patients (82.2%, n=37) were evaluated with qSOFA scores equal to 2 and 3 points, while 17% (8 patients) remained with 1 point indicating a hidden condition during the initial screening.

Additionally, our analysis showed that both SIRS and qSOFA are significant predictors of mortality of septic patients. The SIRS scale had a 2.050-fold probability of predicting the death of a sepsis patient (p=0.004, 95% CI 1.255 – 3.349), whereas qSOFA score was 2.581 times more likely to predict mortality in patients with sepsis and septic shock (p=0.0001, 95% CI 1.557 – 4.279). No significant differences were found in patients with or without sepsis evaluated by SIRS and qSOFA during the length of their hospital stay (t=7.349, p=0.0001) (Table 3).

Finally, we evaluated the specificity and sensitivity of the 30-day mortality predictive value of both scales using ROC curve analysis (Fig. 1). Our results indicated that both scales had more than 80% predictability for death by day 30. For SIRS of more than 2.5 points, sensitivity was 91% and specificity – 60% (AUC 0.80, 95% CI - 0.712 - 0.907). For values above 3.5 points, sensitivity was 57.8% and the specificity was 73.8%. The ROC curve results for qSOFA score greater than 1.5 points indicated sensitivity of 82.2% and specificity of 70.3% (AUC 0.85, 95% CI 0 0.770 - 0.934), while at 2.5 points qSOFA sensitivity was 51% and specificity was 95 %.

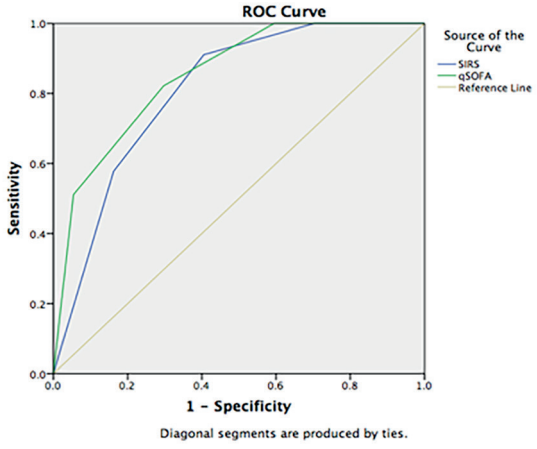

Fig. 1. 30-day mortality predicted by SIRS and qSOFA

DISCUSSION

By evaluating patients on the SIRS and qSOFA scales we could diffrentiate sepsis from sepsis-free infections and monitor mortality by day 30.

From the results obtained, both scales have shown more than 80% predictive probability for death by day 30 (p<0.0001, 95% CI). With SIRS criteria ≥2.5 points, the sensitivity was 91% and the specificity was 40.5% (AUC 0.80, 95% CI - 0.712 - 0.907). With a qSOFA score ≥1.5 points, the sensitivity was

Table 3. Average hospital stay of patients with or without sepsis evaluated by SIRS and qSOFA

	Type of Infection	Number of Patients	Average Score	Standard Deviation
SIRS	Sepsis	45	3.4889	0.66134
	Infection without sepsis	37	2.2703	1.07105
qSOFA	Sepsis	45	2.3333	0.76871
	Infection without sepsis	37	0.9459	0.94122
Days of Hospital Stay	Sepsis	45	11.1333	9.22102
	Infection without sepsis	37	9.8378	5.19355

82.2% and the specificity was 70.3% (AUC 0.85, 95% CI - 0.770 - 0.934). A detailed follow-up of the changes in patients has shown that SIRS criteria were more sensitive to the detection of septic patients, whereas qSOFA criteria were more specific in terms of predicting lethal outcomes.

With the implementation of the new criteria for detection of critically ill and septic patients using the abbreviated and full version of the SOFA score, the pros and cons of qSOFA or SIRS criteria for evaluating these patients began to emerge. More specifically, it was questioned whether the qSOFA score is sufficiently informative to detect severely ill patients compared to the SIRS criteria. According to different authors, each of the scales has an advantage over the other; thus contradictions arise.

In a retrospective follow-up of a 10-year cohort, in 2018, the Khwannimit team published results showing that the SOFA score had the best predictive value for mortality (AUC 0.839) compared to qSOFA (AUC 0.814, P=0.003) and SIRS (AUC 0.587, P<0.0001). In addition, the SOFA score had the best predictive power for ICU mortality and organ failure (11).

In another study, Goulden et al. show the results of a retrospective cohort study comparing qSOFA, SIRS, and NEWS (National Early Warning Score) in the United Kingdom as indicators of hospital mortality. According to their results, NEWS (0.65, 95% CI 0.61– 0.68) and qSOFA (0.62, 95% CI 0.59– 0.66) had similar predictive value (that was better than SIRS) (12).

According to a study conducted by Haydar et al., the qSOFA score is a better predictor of sepsis mortality though determining it in emergency rooms requires more time than using the SIRS criteria. The authors make an interesting follow-up in patients suspected to have sepsis and determine the time when both scales should be calculated. Initially, on arrival at the emergency ward, they stated that 94.5% of patients had SIRS criteria, while only 58.3% met qSOFA criteria. The mean time to obtain results for the SIRS criteria was 47.1 minutes (95% CI 36.5 - 57.8), compared to 84.0 minutes (95% CI 62.2 - 105.8) for the qSOFA score. The median (time) for determining SIRS criteria was 12 minutes versus 29 minutes for the qSOFA score. Of course, our comment here is that the organization of medical care and meeting with a doctor in most highly developed countries is based on a different criteria, which is why the qSOFA determination time could vary (13).

Another metaanalysis conducted in 2018 by Jiang et al. showed that qSOFA score≥2 and SIRS score≥2 are strongly associated with mortality in ED patients with infections. However, it is also clear that qSOFA and SIRS have limitations as risk stratification tools for ED patients with infections. When comparing the performance of qSOFA and SIRS in predicting mortality, qSOFA scores≥2 were more specific; however, SIRS scores≥2 were more sensitive (7).

In a retrospective analysis by Usman et al. (2018) sensitivity, specificity, and area under the receiver-operating characteristic (AUROC) were measured aiming to detect cut-off points of sepsis. They compared SIRS, qSOFA, and the National Early Warning Score (NEWS) for the identification of severe sepsis and septic shock during ED triage. According to their results, qSOFA had the lowest sensitivity and was discussed as a poor tool for ED sepsis screening (9).

In a systematic review and meta-analysis on the use of the qSOFA score and SIRS criteria for septic patient detection and death predictability, Serafim et al. (2018) published results on the better sensitivity of the SIRS criteria for sepsis (RR 1.32; 95% CI, 0.40 - 2.24; P<0.0001; I2=100%). However, qSOFA (RR 0.03; 95% CI, 0.01 - 0.05; P=0.002; I2=48%) was a better predictive marker for in-hospital mortality. The authors note that the use of both scales could provide a better model for initial therapy in patients with sepsis (14), an opinion that we fully support with the data obtained in our study.

To sum up, our results indicated that the qSOFA score had better predictive value for the detection of severe conditions in septic patients and a greater likelihood of death predictability at 30-day follow-up (AUC 0.85, 95% CI 0.770 - 0.934, p<0.0001). Despite that, a small percentage of septic patients remained undiagnosed with qSOFA even though they scored 3 or 4 points, respectively, according to the SIRS criteria. It is in this group of patients that a high level of suspicion for sepsis should be maintained. In our clinical practice, there are often patients who are not

suspected of sepsis during the initial physical check. Therefore further analysis should be required to confirm the diagnosis so that an early-onset therapy can be initiated according to the SEPSIS-3 guidelines.

CONCLUSISON

The use of qSOFA and SIRS criteria for early detection of sepsis and treatment therapy decision-making are key factors for reducing mortality. The simultaneous use of both scores in practice could lead to a wider coverage of septic patients and better outcomes, i.e. decrease in mortality and disability rates and less psycho-trauma for the patients and their families.

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