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Research note

Accuracy of quick sequential organ failure assessment score to predict mortality in hospitalized patients with suspected infection in an HIV/AIDS reference centre in Rio de Janeiro, Brazil

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ABSTRACT

Objectives: : To compare the discriminatory capacity of the quick sequential organ failure assessment (qSOFA) vs. the systemic inflammatory response syndrome (SIRS) score for predicting 30-day mortality and intensive care unit (ICU) admission in patients with suspicion of infection at an HIV reference centre.
Methods: We performed a prospective cohort study including consecutive adult patients who had suspected infection and who were subsequently admitted to the medical ward. Variables related to qSOFA and SIRS were measured at admission. The performance (area under the receiver operating curve, AUROC) of qSOFA (score ≥2) and SIRS (≥2 criteria) as a predictor of 30-day mortality and ICU admission was evaluated.
Results: One hundred seventy-three patients (mean ± standard deviation age, 42.6 ± 12.4 years) were included in the analysis; 107 (61.8%) were male, and 111 (64.2%) were HIV positive. Respiratory and gastrointestinal infections occurred in 49 (28.3%) and 23 (13.3%), respectively. The 30-day mortality rate was 9 (5.2%) of 173. The prognostic performance of qSOFA was similar compared to SIRS, with an AUROC of 0.68 (95% confidence interval, 0.55–0.81) and 0.69 (95% confidence interval, 0.53–0.86) (p 0.96). Twenty patients (11%) were admitted to the ICU; qSOFA and SIRS had a similar discriminatory capacity for ICU admission (AUROC 0.63 (95% confidence interval, 0.51–0.75) and 0.63 (95% confidence interval, 0.50–0.76)), respectively).
Conclusions: We found a poor prognostic accuracy of the qSOFA to predict 30-day mortality in hospitalized patients suspected of infection in a setting with a high burden of HIV infection. **J. Moreira, Clin Microbiol Infect 2019;25:113.e1–113.e3**

Introduction

Sepsis, a life-threatening organ dysfunction caused by a dysregulated host response to infection, is a clinical entity associated with morbidity and mortality worldwide [1]. Early recognition is critical as prompt initiation of appropriate therapy improves outcomes. In 2016, the Sepsis-3 consensus proposed a new bedside score, the quick sequential organ failure assessment (qSOFA), to help clinicians identify septic patients among those with suspected infection [1]. Composed of three easy-to-measure clinical parameters, qSOFA exhibited higher predictive validity for in-hospital mortality than systemic inflammatory response syndrome (SIRS)

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criteria among patients with suspected infection outside the intensive care unit (ICU).

Prospective studies validating the qSOFA conducted in resource-limited settings with a high burden of HIV infection and with distinct underlying infectious syndromes are rare. Considering the properties of qSOFA (i.e. rapidly and easily assessable at the bedside and lack of laboratory testing), it is a highly attractive tool to be applied even in resource-constrained countries. Therefore, we examined the performance of qSOFA to predict mortality in patients with suspected infection and secondarily evaluated the prediction for ICU admission.

Methods

We conducted a prospective observational cohort study. All patients attending an adult medical ward at an HIV reference centre in Rio de Janeiro, Brazil, between February 2017 and January 2018 were included in the study. We excluded patients who had already been admitted, those who refused to participate, pregnant women, those with admission lasting <48 hours and patients admitted only for palliative care. Thus, the unit of analysis was each patient. For the current analysis, we included patients with suspected infection diagnosed by the treating physicians based on the identification of an infectious source (whether clinical, radiologic or microbiologic) or initiation of treatment for an infection, including antibiotics and antifungals. For each recruited patient, the study team collected sociodemographic data; clinical, laboratory and microbiologic data; and components comprising qSOFA and SIRS criteria. The qSOFA score allocates 1 point for each of the following: respiratory rate ≥22 breaths per minute, altered mental status and systolic blood pressure ≤100 mm Hg. Altered mental status was defined as a Glasgow coma scale ≤14. The SIRS criteria include respiratory rate >20 breaths per minute or $PaCO_2$ <32 mm Hg; temperature higher than 38°C or <36°C; pulse >90 beats per minute; and white blood cell count >12 000/μL or <4000/μL or with more than 10% bands. The latter two scores were recorded at the time of ward admission and were chosen because there is mixed evidence on the clinical utility of qSOFA vs. SIRS for identification of patients likely to have sepsis. Furthermore, variables related to HIV infection were also extracted. Recent HIV diagnosis was defined as an HIV diagnosis within 2 months of hospital admission. For hospitalized patients who were subsequently admitted to the ICU, we extracted the proportion of ICU admission and the length of ICU stay.

The primary endpoint was 30-day mortality, defined as death from any reason occurring in the 30 days after admission. Patients who were discharged from hospital before day 30 were followed until 1 June 2018, date of death or day of their last outpatient visit, whichever occurred first. For patients who were lost to follow-up before the endpoint visit, the follow-up time until their last known assessment of vital status was determined, and the data were censored after that.

Secondary endpoints included admission to ICU and length of ICU stay. Categorical variables were expressed as number and percentages, and continuous variables were expressed as mean ± standard deviation or as median (interquartile range), depending if normality was assumed. To assess the performance of the qSOFA to predict the primary endpoint, we calculated diagnostic performances (sensitivity, specificity, predictive values and likelihood ratios) for a qSOFA score of ≥2. Performance of the latter score was compared to SIRS ≥2 to predict the primary endpoint. We also calculated the area under the receiver-operating characteristics curve (AUROC). Because our centre is a regional centre for HIV infection, a significant proportion of HIV-related hospitalizations occur. We thus also assessed the impact of adding HIV status as an additional risk factor to the qSOFA score by allocating 1 extra point for HIV seropositivity but still applying a ≥2 cutoff to the total score. Survival curves between those with an initial qSOFA score <2 and ≥2 at ward admission were compared by log-rank test. All statistical analyses were 2-tailed; $p < 0.05$ was considered significant. SPSS 23.0 software (IBM, Armonk, NY, USA) was used for statistical analysis. The local ethics review board approved the study protocol, and written consent was obtained from all patients for participation.

Results

During the study period, 588 hospitalizations occurred. We further limited our sample to the first episode of hospital admission, which corresponded to 237 patients. Sixty-four subjects were excluded at the time of ward admission because they did not have an infection, leaving 173 to be included in the final analysis. The mean ± standard deviation age was 42.6 ± 12.4 years, and male sex predominated (61.8%). With respect to the site of infection, respiratory and gastrointestinal infections were the main focus in 49 (28.3%) and 23 (13.2%) patients, respectively (Supplementary Table S1). Tuberculosis was the leading infection in our cohort; it was responsible for 53 (31%) of the admissions of patients with infection. The HIV prevalence among the cohort was 111 (64.2%) of 173, including 24 new diagnoses. There were no differences in the $CD4^+$ cell count between discharged and surviving patients (134 (interquartile range (IQR) 50–355) vs. 305 (IQR 77.5–672) cells/mm^3, p 0.18, respectively). The qSOFA and SIRS scores were ≥2 for 37 (21.4%) of 173 and 93 (53.8%) of 173 patients, respectively.

The 30-day mortality was nine (5.2%) of 173, and in-hospital mortality was ten (5.7%) of 173. The prognostic performance to predict 30-day mortality of qSOFA was similar compared to SIRS, with an AUROC of 0.68 (95% confidence interval (CI), 0.55–0.81) and 0.69 (95% CI, 0.53–0.86) (p 0.96), for the difference between the AUROC, respectively (Table 1). The modified qSOFA in HIV-infected patients had an increased sensitivity to 100% (95% CI, 59–100), but with a decreased specificity (39%; 95% CI, 29–49).

Admission to ICU occurred in 20 (11%) of 173 patients; for patients with qSOFA scores of <2, it was 14 (10%) of 136 vs. 6 (16%) of 37 for patients with a qSOFA score of ≥2 (absolute difference, 9%). The length of ICU stay was similar between patients with qSOFA <2 and ≥2 (3 (IQR 2–10) vs. 3.5 (IQR 2–13) days), p 0.89, respectively). Table 2 shows the predictive accuracy of qSOFA and SIRS for ICU admission.

The mean follow-up time after hospital admission was 14.13 months (95% CI, 13.61–14.65). The mean survival time was similar between those with an initial qSOFA score <2 and ≥2 at ward admission (14.2 vs. 13.7 months, p 0.51). Readmission occurred in 52 patients (30%) and a median time of 65 (range, 14.2–173) days after index hospitalization.

Discussion

We found a poor prognostic accuracy of the qSOFA score to predict 30-day mortality in hospitalized patients suspected of infection in a setting with a high burden of HIV infection. These findings concur with a recent meta-analysis, which found that the predictive accuracy of qSOFA to predict in-hospital mortality in non-ICU encounters is poor (area under the curve (95% CI) = 0.71 (0.67–0.75)) [2]. Moreover, our findings contrast with the performances obtained in the derivation and validation cohorts used for the developmental of qSOFA in high-income settings, where qSOFA outperformed SOFA and SIRS (AUROC = 0.81, 0.79 and 0.76, $p < 0.001$, respectively) for in-hospital mortality among encounters with suspected infection outside of the ICU [1].

Table 1
Diagnostic performances of different scores to predict 30-day mortality in HIV referral centre, Rio de Janeiro, Brazil, 2017–2018

Characteristic	qSOFA ≥2	SIRS ≥2	qSOFA + HIV status ≥2
Sensitivity,% (95% CI)	33 (7–70)	77 (40–97)	100 (59–100)
Specificity,% (95% CI)	77 (69–83)	46 (37–54)	39 (29–49)
PPV,% (95% CI)	8 (3–19)	8 (5–11)	10 (8.7–11.4)
NPV,% (95% CI)	95 (92–96)	97 (91–99)	100 (89–100)
PLR,% (95% CI)	1.47 (0.56–3.88)	1.44 (1–2.10)	1.63 (1.40–1.91)
NLR,% (95% CI)	0.86 (0.54–1.38)	0.48 (0.14–1.66)	0
AUROC (95% CI)	0.68 (0.55–0.81)	0.69 (0.53–0.86)	0.68 (0.54–0.83)

AUROC, area under the receiver operating characteristics curve; CI, confidence interval; NLR, negative likelihood ration; NPV, negative predictive value; PLR, positive likelihood ratio; PPV, positive predictive value; qSOFA, quick sequential organ failure assessment; SIRS, systemic inflammatory response syndrome.

Table 2
Diagnostic performances of different scores to predict intensive care unit admission in HIV referral centre, Rio de Janeiro, Brazil, 2017–2018

Characteristic	qSOFA ≥2	SIRS ≥2
Sensitivity,% (95% CI)	30 (11–54)	70 (45–88)
Specificity,% (95% CI)	79 (72–85)	48 (40–56)
PPV,% (95% CI)	16 (8–28)	15 (11–19)
NPV,% (95% CI)	89 (86–92)	92 (86–96)
PLR,% (95% CI)	1.48 (0.71–3.10)	1.36 (0.98–1.88)
NLR,% (95% CI)	0.88 (0.65–1.18)	0.62 (0.31–1.24)
AUROC (95% CI)	0.63 (0.51–0.75)	0.63 (0.50–0.76)

AUROC, area under the receiver operating characteristics curve;; CI, confidence interval; NLR, negative likelihood ration; NPV, negative predictive value; PLR, positive likelihood ratio; PPV, positive predictive value; qSOFA, quick sequential organ failure assessment; SIRS, systemic inflammatory response syndrome.

Our findings are similar to a study conducted in Malawi (HIV infection rate, 54%), where the investigators found a modest predictive ability of qSOFA to identify patients at risk of adverse outcomes (AUROC (95% CI) = 0.73 (0.68–0.78)) [3]. Whether or not underlying HIV infection plays a significant role in qSOFA performance is a question that merits further exploration. Possibly the differences are related to the severity of illness at presentation, the standard of care in different geographical settings and distinct patient populations. With a low sensitivity and high specificity in different settings and geographical areas, the usefulness of qSOFA in the contemporary clinical practice is at a crossroads. For clinicians working in resource-constrained settings, the best strategy to apply this simplified assessment score is unclear. Implementation research should inform whether positive qSOFA could improve patient outcomes; it seems to us that the primary role of the qSOFA is to aid in risk stratification in those at risk of sepsis who have already been identified by SIRS, or to serve as an allocation tool in settings where the availability of intensive care is markedly limited.

The added value of HIV status in the qSOFA score was questionable, as this resulted in a low specificity, leading to misclassification of low-risk patients. Concentrating limited resources on such a large group of patients is not feasible, and considering our experience, we recommend against the incorporation of HIV status in risk stratification.

We agree with others that SIRS criteria have a poor discriminatory validity for mortality, but it still can play a vital role in identifying patients with infection who may benefit from antimicrobial therapy, fluids and additional screening for organ dysfunction [4]. At this stage, we believe it should continue to be routinely used in clinical practice until proven otherwise.

The main limitations of our study are the small sample size, single-centre design and occurrence of few outcomes of interest (i.e. only nine patients met the primary endpoint). Additionally, we only measured qSOFA at one point in time, thus neglecting the dynamic nature of sepsis, which may be better captured with serial evaluations throughout hospitalization.

Regarding the study's strengths, a prospective evaluation of qSOFA at time of the hospital admission was undertaken not only focusing on 30-day mortality but also on ICU admission. We continue to follow up discharged patients to assess medium-term complications.

In conclusion, we found that the qSOFA has poor performance ability to predict 30-day mortality in hospitalized patients with suspected infection in a setting with a high burden of HIV infection. We emphasize the need to further validate the qSOFA in different settings if a more broad adoption of the Sepsis-3 guidelines is expected to be introduced into routine daily practice.

Transparency declaration

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.cmi.2018.08.003.

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