Journal of Critical Care 42 (2017) 12–17

Contents lists available at ScienceDirect

Journal of Critical Care

journal homepage: www.jccjournal.org

Quick sequential organ failure assessment compared to systemic inflammatory response syndrome for predicting sepsis in emergency department

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ARTICLE INFO

Keywords:
qSOFA
Organ failure
Sepsis
Emergency department

ABSTRACT

Purpose: It is unclear whether quick sequential (sepsis-related) organ failure assessment (qSOFA) also has prognostic value for organ failure in patients with a suspected infection. The aim of this study was to determine whether qSOFA has prognostic value when compared to systemic inflammatory response syndrome (SIRS) in predicting organ failure in patients with a suspected infection in an emergency department (ED).
Methods: A retrospective observational study was conducted in an ED during a 9-year period. We analyzed the ability of qSOFA compared to SIRS to predict the development of organ failure in patients (defined as an increase in the SOFA score of 2 points or more) using the area under receiver operating characteristic (AUROC) curve.
Results: A total of 1009 patients with suspected infection were finally included in the study. The predictive validity of qSOFA for organ failure was higher than that of SIRS (AUROC = 0.814 vs. AUROC = 0.662, $p = 0.02$). qSOFA was also superior to SIRS in predicting in-hospital mortality (AUROC = 0.733 vs. AUROC = 0.599, $p = 0.04$). When the qSOFA score was equal to or >1, its sensitivity and specificity to predict organ failure was 75% and 82%, respectively.
Conclusions: qSOFA has a superior ability compared to SIRS in predicting the occurrence of organ failure in patients with a suspected infection. However, given the low sensitivity of qSOFA, further confirmatory tests for organ failure are needed.

1. Introduction

Since the 1991 consensus conference, sepsis has been defined as a proven or suspected infection accompanied with two or more systemic inflammatory response (SIRS) criteria [1]. The SIRS criteria has been used to treat and research sepsis for a long time [2]. However, there has been conflicting evidence regarding the value of SIRS [3-8], with the SIRS criteria being criticized for having inadequate specificity and sensitivity [9,10].

New definitions for sepsis and septic shock have been published [10]. Sepsis is defined as a life-threatening organ dysfunction due to a dysregulated response to an infection, and organ dysfunction is defined as an increase in a sequential (sepsis-related) organ failure assessment (SOFA) score of 2 points or more [10]. The concept of SIRS has thus disappeared from this new definition of sepsis. The task force for international consensus definitions for sepsis and septic shock has introduced a new screening tool named quick SOFA (qSOFA) that has a predictive validity superior to that of SOFA and SIRS for in-hospital mortality outside an intensive care unit (ICU) [11].

When compared to previous definition, sepsis has become a more severe disease that is associated with in-hospital mortality of >10% [10]. Nowadays, it is more important to distinguish sepsis from an uncomplicated infection because sepsis has poorer outcomes, and prompt recognition with the corresponding intervention, such as administering fluids and appropriate antibiotics early, can improve its prognosis [12]. qSOFA has been recommend to screen sepsis based on its prognostic value for in-hospital mortality outside the ICU. However, it is currently unclear whether qSOFA can be used to directly identify organ failure in patients with an infection in terms of differentiation from uncomplicated infection. Therefore, the

Abbreviations: AUROC, area under receiver operating characteristic; AVPU, alert/verbal/painful/unresponsive; ED, emergency department; GCS, Glasgow Coma Scale; NPV, negative predictive value; PPV, positive predictive value; qSOFA, quick sequential (sepsis-related) organ failure assessment; SIRS, systemic inflammatory response syndrome; SOFA, sequential (sepsis-related) organ failure assessment.

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http://dx.doi.org/10.1016/j.jcrc.2017.06.020
0883-9441/

objective of this study was to determine the prognostic value of qSOFA compared to SIRS to predict organ failure in patients with a suspected infection in the emergency department (ED) within 24 h of ED admission.

2. Methods

2.1. Study design and population

This retrospective cohort study was conducted in an academic ED of a university-affiliated hospital in Seoul, Korea. Intensivists are available for patients who require sepsis management 24 h a day, 7 days a week. The Institutional Review Board of our hospital approved this study before its commencement, and the requirement for informed consent was waived by the IRB due to its retrospective review nature.

2.2. Data collection and patient management

The electronic medical records were reviewed for all consecutive adult patients (≥18 years) with a suspected infection that was identified using a combination of antibiotics (oral or parenteral) and body fluid cultures (blood, urine, cerebrospinal fluid, etc.) [11]. The study period was between March 2007 and February 2016. We excluded situations that could affect qSOFA at triage or where tracing primary outcomes is impossible. Patients were excluded if they had been transferred from another hospital and also if they were discharged or transferred to another hospital within 24 h after ED admission. Patients who were in a state of arrest at ED arrival were also excluded. The primary outcome was the development of new or progressive organ failure defined as an increase in the SOFA score of 2 points or more within 24 h of ED admission over baseline functioning. The secondary outcome was the in-hospital mortality.

The clinical and demographic characteristics (including age, sex, comorbidities, initial vital signs, sites of infection, laboratory findings and clinical outcomes) were retrieved from the electronic hospital records of all patients. The initial vital signs at triage were used to calculate the qSOFA and SIRS criteria. The qSOFA criteria were: respiratory rate ≥22/min, systolic blood pressure ≤100 mm Hg, and altered mentation [11]. In our ED, the alert/verbal/painful/unresponsive (AVPU) responsiveness scale was used at triage. All cases except 'alert' were judged to have altered mentation. When calculating the full SOFA score, the PaO_2/FiO_2 ratio was used if there was a result of arterial blood gas analysis and the SpO_2/FiO_2 ratio was used if there was no PaO_2 information [13]. The AVPU responsiveness scale was used as a surrogate of the Glasgow Coma Scale (GCS) [14]. For single missing values (i.e., laboratory findings of the 2nd hospital day), the baseline values (1st hospital day) were used as the worst ones to calculate the SOFA score. The maximum SOFA score was calculated at 24 h after ED admission. The general treatment of patients followed the guidelines of surviving sepsis campaign international guidelines. The decision to perform renal replacement therapy or ICU treatment was at the discretion of the intensivists.

2.3. Statistical analysis

The data in this study is presented as mean ± standard deviation of the mean or median with an interquartile range for continuous variables. For the categorical variables, the data are presented as absolute or relative frequencies. Patients who developed organ failure within 24 h after ED admission were compared to those without organ failure. Student's *t*-test or the Mann-Whitney *U* test was used to compare continuous variables. The Chi-square test was used to compare categorical variables. The area under the receiver operating characteristic (AUROC) curve was computed to compare the prognostic value of qSOFA to that of SIRS for organ failure and in-hospital mortality. The

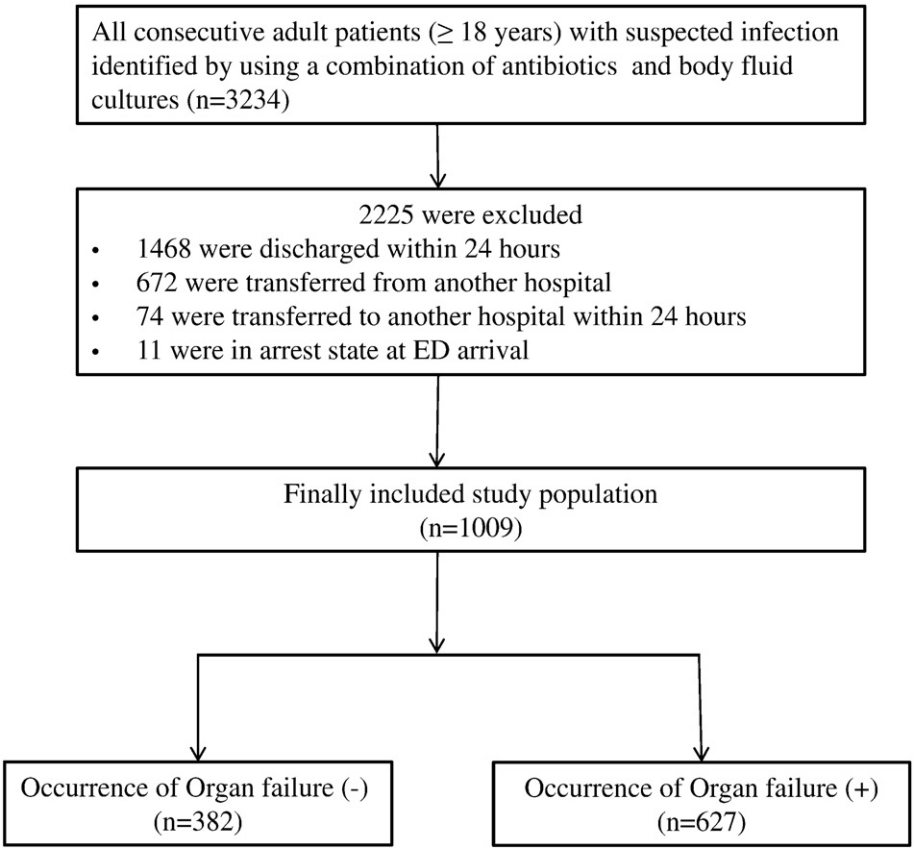

Fig. 1. Patient flow diagram. Abbreviations: ED, emergency department.