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RESEARCH

THE USE OF QUICK SOFA (QSOFA) IN ELDERLY PATIENTS WITH SEPSIS IN THE INTENSIVE CARE UNIT

Abstract

Introduction: In elderly patients with clinically diagnosed sepsis, we investigated the performance of quick sepsis-associated organ failure assessment in admission to the mortality and intensive care unit and compared its performance with acute physiology and chronic health assessment, assessing systemic inflammatory response syndrome, sepsis-related organ failure.

Materials and Method: From February 2016 to February 2017, we retrospectively reviewed 92 elderly patients (≥65 years of age) who were clinically diagnosed with sepsis in the intensive care unit. We compared the performance of organ failure assessment associated with sepsis, acute physiology and chronic health assessment II, systemic inflammatory response syndrome, and quick sepsis related with organ failure assessment, foreseeing a 28-day mortality in the intensive care unit.

Results: The scores of organ failure assessment associated with quick sepsis were 1 in 6.5% (n=6), 2 in 30.4% (n=28) and 3 in 63% (n=58) Mean sepsis-related organ failure rating score was 9.2±3.0, mean systemic inflammatory response syndrome score was 2.6±0.6, and acute physiology and chronic health assessment score II was 25.4±7.2. There was a statistically significant difference ($p<0.001$) between patients with mortality rates of> 7 and <7 and 81% and 31% respectively in patients with organ failure assessment score associated with sepsis.

Conclusion: Quick sepsis related organ failure assessment may be a better alternative in determining mortality risk, since it can be easily applied when compared to sepsis related organ failure assessment in geriatric patients.

Keywords: Organ dysfunction scores; Sepsis; Geriatrics; Critical care

ARAŞTIRMA

YOĞUN BAKIM ÜNİTESİNDE SEPSİS TANILI YAŞLI HASTALARDA HIZLI SOFA (QSOFA) KULLANIMI

Öz

Giriş: Klinik olarak tanısı konmuş sepsis olan yaşlı hastalarda mortalite ve yoğun bakım ünitesine kabul etmede hızlı sepsis ile ilişkili organ yetmezliği değerlendirmesinin performansını araştırdık ve performansını sistemik inflamatuar yanıt sendromu, sepsis ile ilişkili organ yetmezliği değerlendirmesi ve akut fizyoloji ve kronik sağlık değerlendirmesi ile karşılaştırdık.

Gereç ve Yöntem: Şubat 2016'dan Şubat 2017'ye kadar, yoğun bakım ünitesinde klinik olarak sepsis tanısı alan 92 yaşlı (≥65 yaş) hastayı retrospektif olarak inceledik. Yoğun bakım ünitesinde 28 günlük mortaliteyi öngörmede sepsis ile ilişkili organ yetmezliği değerlendirmesi, akut fizyoloji ve kronik sağlık değerlendirmesi II, sistemik inflamatuar yanıt sendromu ve hızlı sepsis ile ilişkili organ yetmezliği değerlendirmesinin performansını karşılaştırdık.

Bulgular: Hızlı sepsis ile ilişkili organ yetmezliği değerlendirmesi skorları %6.5 (n=6) hastada 1, %30.4 (n=28) hastada 2 ve %63 (n=58) hastada 3 idi. Ortalama sepsis ile ilişkili organ yetmezliği değerlendirmesi skoru 9.2±3.0, ortalama sistemik inflamatuar yanıt sendromu skoru 2.6±0.6 ve akut fizyoloji ve kronik sağlık değerlendirmesi II skoru 25.4±7.2 idi. Ölüm oranları >7 and <7 sepsis ile ilişkili organ yetmezliği değerlendirmesi skoru olan hastalarda sırasıyla %81 ve %31 olup, aralarında istatistiksel olarak anlamlı bir fark bulunmuştur ($p<0.001$).

Sonuç: Geriatrik hastalarda sepsis ile ilişkili organ yetmezliği değerlendirmesiyle karşılaştırıldığında kolay uygulanabilmesi nedeniyle hızlı sepsis ile ilişkili organ yetmezliği değerlendirmesi mortalite riskini belirlemede daha iyi bir alternatif olabilir.

Anahtar Sözcükler: Organ disfonksiyonu skorları; Sepsis; Geriatri; Kritik bakım

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INTRODUCTION

According to data from the Turkish Statistical Institute, the proportion of the geriatric population was 7.5% in 2012, which has increased to 8.3% in 2016. Males constitute 43.9% and females constitute 56.1% of the geriatric population (1). In many countries, the average age and life expectancy of the population are also increasing. As a result, a growing number of older patients are admitted to the intensive care unit. In the intensive care unit, geriatric patients and their treatment may be different from that of younger patients. In fact, the duration of intensive care unit stay was found to be longer in patients aged >75 years than in patients aged <65 years (2). Currently, a significant number of patients in the intensive care unit are geriatric patients with numerous, life-threatening, progressive, and irreversible disorders, and the indications of hospitalization in the intensive care unit are similar to those of younger patients. Clearly, being in the geriatric age group is not a contraindication to intensive care unit admission (3).

The definitions of sepsis and septic shock were recently modified in The Third International Consensus Definitions for Sepsis and Septic Shock (4). The quick sepsis-related organ failure assessment (qSOFA) is a new screening tool that has been recommended to evaluate sepsis in accordance with its new definition (5). The qSOFA criteria for sepsis include a Glasgow Coma Scale score of ≤13, systolic blood pressure ≤100 mmHg, and respiratory rate ≥22 cycles/min (1 point each to yield a score value between 0 and 3) (5). According to the recommendations in Sepsis-3, patients outside the intensive care unit with a qSOFA score of ≥2 who are suspected to have an infection should be closely monitored for sepsis and further assessed using the SOFA score. Simplicity in the calculation and close accordance with complex systems used for non- intensive care unit settings are the main advantages of qSOFA. Furthermore, its independence from laboratory test results means that qSOFA can be calculated within a few minutes at the patient's bedside. The Surviving Sepsis Campaign also recommended that further investigations are required for qSOFA's sensitivity (6). However, no study was conducted using qSOFA in predicting mortality of elderly patients aged over 65 years.

This study aimed to investigate the performance of qSOFA for predicting mortality of geriatric patients with clinically diagnosed infection in the intensive care unit and to compare its performance with those of systemic inflammatory response syndrome, acute physiology and chronic health evaluation II, and sepsis-related organ failure assessment.

MATERIALS AND METHOD

The study was a single-center, retrospective analysis of a prospective observational research database in patients with clinically diagnosed sepsis at the ICU from February 2016 to February 2017. This study was approved by the ethics committee of our institution.

Elderly patients (≥65years old) with sepsis, and admitted in the ICU were included in the study. The exclusion criteria were as follows: age <65 years, terminal disease, human immunodeficiency virus positivity, and use of immunosuppressant.

Data on demographic characteristics, comorbidities, infection sites, vital signs, imaging, and results of the laboratory test of enrolled patients were recorded upon ICU admission. qSOFA, SOFA, APACHE II, and SIRS scores were calculated using the data obtained during enrollment. Patient mortality rate was followed up for 28 days.

Data analysis was done using SPSS version 18 (SPSS Inc., Chicago, IL, USA). The individual relationship of each score qSOFA, simplified acute physiology score (SAPS), and APACHE) and length of admission with the risk of death and the comparison of the score was done using-test and ANOVA. P-value of <0.05 was considered statistically significant. The means of continuous variables were compared using Student's *t*-test. Predicted mortality was calculated using the

original regression formulas. Categorical variables were compared using either chi-square test or Fisher's exact test. Discrimination was tested using the receiver operating characteristic (ROC) curves and by comparing areas under the curve (AUC). AUCs >0.8 were considered excellent and 0.6–0.8 were acceptable.

RESULTS

Of the 312 admissions during the study period, 92 (29.4%) patients who met the inclusion criteria were included in the final analysis. The average age of patients was 78.5±9.2 years. Of the subjects, 55 (59%) were women and 37 (41%) were men. Furthermore, 93.5% (n=86) of patients had at least and 6.5% (n=6) without comorbidity. Forty-nine had ≤2 comorbidities; by contrast, 37 patients had ≥3 comorbidities. The determined comorbidities were congestive heart failure (29.3%), chronic obstructive lung disease (31.5%), renal failure (12%), cerebrovascular disease (27.2%), type II diabetes mellitus (25%), malignancy (18.5%), hypertension (58.7%), and others (25%). The source of infection was pulmonary (63%; n=58) and other sources (37%; n=34) (Table 1).

Table 1. Comparison between the baseline characteristics of patients.

Parameter of interest	Overall	Survivors (n=32)	Non-survivors (n=60)	p
Age (years)	78.5±9.2	76.2±8.8	79.7±9.3	0.08
Sex				
Males	37	19	36	0.954
Females	55	13	24	
ICU stay(days)	10.2±8.5	11.7±10.1	9.5±7.5	0.245

* p<0.05 was considered significant. ICU: intensive care unit, MV: mechanical ventilation, RRT: renal replacement therapy.

The 28-day mortality rate was 65.3% (n=60). The length of ICU stay was 10.2±8.5 days. Moreover, 27.2% (n=25) of patients were discharged and 7.6% (n=7) stayed in the ICU after 28 days.

qSOFA scores were 1 in 6.5% (n=6), 2 in 30.4% (n=28), and 3 in 63% (n=58) of patients. The mean SOFA score was 9.2±3.0, the mean SIRS score was 2.6±0.6, and the mean APACHE II score was 25.4±7.2.

No statistically significant difference was found between gender (p=0.954), age (p=0.323), comorbidity (p=0.493), congestive heart failure (p=0.439), chronic obstructive lung disease (p=0.493), renal failure (p=0.218), cerebrovascular disease (p=0.732), diabetes mellitus (p=0.312), malignancy (p=0.961), hypertension (p=0.153), and pulmonary infection (p=0.324).

The mortality rate was 33.3%, 53.6%, and 74.1% in patients with qSOFA score of 1, 2 and 3, respectively. This difference was statistically significant (p=0.01).

Mortality was higher in patients with qSOFA of >2 than those with qSOFA≤2, which was statistically significant (p=0.01).

The mortality rate was 51.2% in patients with a SIRS score of ≤2 and 75.4% in those with SIRS score of≥3 and this difference was statistically significant (p=0.01).

SOFA and APACHE II scores were higher in patients who subsequently died. The SOFA score of patients who subsequently died was 10.4±2.6 and that of who is still alive was 7.1±2.5 (p<0.0001). The APACHE II score of patients who died was 27.5±6.8 and those who are still alive was 21.5±6.6 (p<0.0001).

APACHE II predicted higher mortality rate in patients who subsequently died (p=0.001).

The AUCs of the 28-day mortality of qSOFA, SOFA, SIRS, and APACHE II were 0.633, 0.804, 0.654, and 0.730, respectively. The AUCs of qSOFA and SOFA were significantly different (p=0.002).

No differences were found between qSOFA and SIRS, qSOFA and APACHE II scores (p=0.704 vs. p=0.109). A statistically significant difference was observed between SOFA and SIRS (p=0.009), but no difference was found between SOFA and APACHE II (p=0.220). There was no difference between SIRS and APACHE II (p=0.229) (Table 2).

Given that the best sensitive and specific area is accepted as a cutoff value in the ROC curves, we calculated the cutoff values of qSOFA at>2, SOFA at >7, SIRS at >2, and APACHE II at >18.The mortality rate was 81% and 31% in patients with SOFA scores of>7 and <7, respectively, in which a statistically significant difference was observed (p<0.001) (Figure 1).

Table 2. Characteristics of scoring systems.

Variables	Whole cohort	Non-survivors	Survivors	p
Illness severity				
qSOFA	2.56±0.6	2.34±0.7	2.68±0.5	0.01
APACHE II	25.4±7.2	21.5±6.6	27.5±6.8	<0.0001
SOFA	9.29±3.0	7.1±2.5	10.4±2.6	<0.0001
SIRS	2.66±0.6	2.40±0.4	2.80±0.8	0.009
28-day mortality	65.2%	65.2%	0%	

qSOFA: quick sepsis-related organ failure assessment, APACHE II: acute physiology and chronic health evaluation II, SOFA: sepsis-related organ failure assessment, SIRS: systemic inflammatory response syndrome

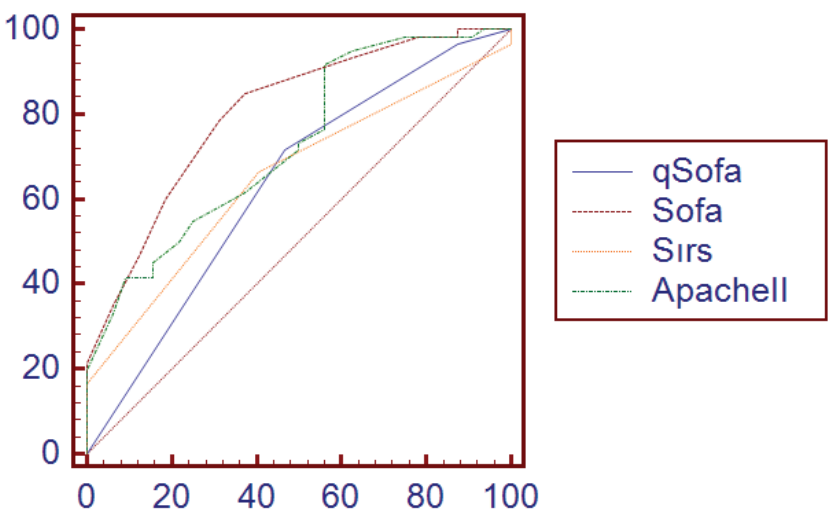

Figure 1. ROC curves of 28-day mortality and ICU admission of patients.

DISCUSSION

Sepsis has a heterogenous disease process and this makes the definition and diagnosis of sepsis crucial. In 2016, the third international consensus on sepsis definitions was published and the definition of Sepsis-3 was declared as "dysregulated host response to an external pathogen" (4). In this conference, qSOFA was defined as a new index to evaluate the patients with suspected infection who are likely to develop sepsis. The qSOFA score was the sum of 1 point for a Glasgow Coma Scale (GCS) of 14 or less, 1 point for a systolic blood pressure of 100 mmHg or less, and 1 point for a respiration rate of 22/min or more.

In a recent study, sepsis was reported as one of the major cause of death in elder patients although new antibiotics and other modern therapies for resuscitation were used (7).

The aging of the population will lead to an increasing demand for critical care resources. Current data suggests that planned surgery for patients ≥80 years of age may benefit from ICU care. A study reported that 27% of patients aged >65 years may need ICU management (8). Scoring systems are used in the ICU to provide clinical information about disease severity and estimated hospital mortality rate. Scoring systems involve the collection of patients' medical and clinical data, and each data variable is assigned with points. These scoring systems can help physicians, patients, and their attendants to select treatment options and allocate the limited ICU resources. They may also help in evaluating the effect of newer treatment modalities and organizational changes.

The scoring system has two parts: a severity score, indicated by a number (the higher the score, the higher the severity), and a calculated probability of mortality (9). The SAPS II is certainly among the most commonly used and validated tools for predicting outcome in the ICUs (10). However, these scoring systems were developed in the 1980s and therefore may be out of date because of the major advances in critical care management of patients in the recent years.

Although newer generations of scoring systems have been developed, these have neither been widely tested and validated nor compared with previous generations of scoring systems.

An ideal scoring system should be able to predict mortality rate correctly, i.e., predicted mortality should be close to the actual mortality rate should be well calibrated, i.e., it should be able to provide risk estimate corresponding to the observed mortality; should have high levels of discrimination, i.e., it should be able to identify patients who are at higher risk of dying; and it should be easy to compute and based on easily available patient parameters.

The accuracy of these scoring systems may not only differ over time but may also vary in different countries because of differences in ethnicity, patient population, health care systems, and ICU structure and organization (11).

Indications of admissions to intensive care were mostly preoperative hemodynamic instability, massive blood transfusion, and respiratory and surgical complications of geriatric patients.

In a retrospective study on the 28-day and 1-year mortality rates of 7,265 geriatric patients, the incidence of heart failure, severe cardiac arrhythmia, and valvular disorders as reasons for ICU admission was found to increase by age. The highest mortality rate was 56% in the >85-year age group and the lowest was 36% in the 65–74-year age group. The SOFA score increased with increasing age and was found to increase with mortality. This study claimed that in patients aged>75 years, mortality might be higher than expected; the need for special care for these patients was emphasized (12).

In our study, the 28-day mortality rate was 65.3%, which was higher than that reported in the original qSOFA study (13). The possible reason for the higher mortality in the present study may be that older patients have more comorbidities and greater illness severity.

Wang et al. have shown that the AUC for qSOFA in predicting mortality was lower than those for APACHE II, SOFA, and MEDS scores, but only the difference between qSOFA and MEDS was statistically significant (14). In the present study, the AUCs of qSOFA and SOFA were significantly different; on the contrary, no difference was found between APACHE II and SIRS.

Askim et al. showed that a SIRS score of≥2 had higher sensitivity than qSOFA in predicting both 7-day and 30-day mortality (15). In addition, our findings supported (75.4%) this argument. Identification and treatment of sepsis in a heterogeneous group are challenging because of age, comorbidities, and type of infection (16-18). In our study, comorbidities and mean age are higher than those in other studies, which are attributed to high mortality rate.

The major drawback of this study was the small sample size. Of the 312 elderly patients, only 92 were included as it was a time-limited study. Further studies involving a large population investigated on a daily basis until the patient was discharged or shifted can be conducted to predict the outcome of ICU stay using daily scores of qSOFA, SAPS, and APACHE. Another limitation of our study was that it was a single-center retrospective study; hence, the results may lack wider applicability.

In conclusion, qSOFA was found as successful as SOFA in determining the mortality rate of geriatric patients in the ICUs. qSOFA can be a better alternative in detecting mortality risk in geriatric patients because of its easy application as compared with that of SOFA.

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