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Practical possibilities in using q SOFA scale by Emergency Medical Teams

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Abstract

Sepsis is a life-threatening dysfunction of the body that causes a host to respond incorrectly to an infection. Sepsis and septic shock are a major health issue affecting millions of people each year worldwide. Every fourth person with sepsis dies. Multi-organ trauma, acute myocardial infarction or stroke, early diagnosis and management in the first hours after the onset of sepsis improve survival rate [1]. The Sequential Organ Failure Assessment (SOFA) scale is mainly used to assess sepsis. SOFA helps medical staff to assess the risk of morbidity and mortality due to sepsis. The basic parameters of SOFA are: assessment of the respiratory system based on partial oxygen pressure in the blood (PaO₂), assessment of the nervous system based on the Glasgow Coma scale (GCS), assessment of the cardiovascular system based on the average blood pressure or after vasopressor administration (any dose), assessment of liver function based on the level of bilirubin in the blood, assessment of kidney function based on the level of creatinine in the urine, assessment of blood clotting based on the amount of thrombocytes contained in the plasma. This scale is used in hospital settings.

qSOFA (Quick Sequential Organ Failure Assessment score) is a simplified version of the SOFA score as the first way to identify high-risk patients due to poor results associated with infection. qSOFA simplifies the SOFA score drastically, taking into account only three clinical criteria and introducing "any change" instead of requiring GCS ≤ 13 . It uses three criteria, assigning one point for low blood pressure (SBP ≤ 100 mmHg), high respiratory rate (≥ 22 breaths per minute) or changed mentation (GCS < 15). qSOFA is a predictor of mortality, not a diagnostic test for sepsis.

Keywords: *Sequential Organ Failure Assessment score, quick Sequential Organ Failure Assessment score, paramedic, early recognition of sepsis.*

Introduction

The concept of sepsis introduced by Hippocrates has been known since the 4th century BC. The word "sepsis" meant the process of rotting or the decomposition of organic matter. It was not until later that the causes, symptoms and course of this organism response to infection were known. After the discovery of microbes in the XIX th century, sepsis changed its definition to blood infection by bacteria. However, it was only in the XX th century that the real reason for the incidence of sepsis was found. In 1991, a conference was held in the USA where basic definitions and criteria for sepsis were agreed. The new definition described the systemic symptoms resulting from the inflammatory response of the body.

Division of sepsis

- ✓ **Systemic inflammatory response syndrome (SIRS)** is an inflammatory process that has different origins. Characteristic symptoms are: body temperature lower than 38°C or greater than 36°C , tachycardia above 90 / min, tachypnoe above 20 / min or PaCO₂ below 32 mmHg, leukocytes count above 12,000 or below 4000, or above 10% of immature neutrophil forms.
- ✓ **Sepsis is SIRS**, which is a specific reaction of the body to infection.
- ✓ **Severe sepsis** is the sepsis that caused hypoperfusion and organ dysfunction.
- ✓ **Septic shock** is severe sepsis with low blood pressure, impaired tissue perfusion despite proper vascular bed filling.

- ✓ **Multiorgan dysfunction syndrome (MODS - multiorgan dysfunction syndrome)** occurs in sepsis when homeostasis cannot be maintained without intensive treatment [2].

Task force 2016 set up by national associations, including the Society of Critical Care Medicine (SCCM) and the European Society of Intensive Care Medicine (ESICM), proposed a new definition of sepsis, referred to as Sepsis-3 [3]. The new proposal defines sepsis as a life-threatening organ dysfunction caused by dysfunctional host response to infection [3-6]. The new definition abandoned the use of the host systemic inflammatory response syndrome (SIRS) criteria to identify sepsis and eliminated the term severe sepsis. The earlier definition of sepsis (Sepsis-1) was developed at the conference in 1991 [6], in which the SIRS criteria were established. Four SIRS criteria were defined, i.e. tachycardia (heart rate over 90 bpm), tachypnea (RR above 20 breaths / min), fever or hypothermia (temperature above 38°C or below 36°C) and leukocytosis, leukopenia (white blood cells above 1200 / mm³, below 4,000 / mm³ ≥ 10%). Patients meeting two or more of these criteria completed the definition of SIRS, and Sepsis-1 was defined as an infection or suspected infection leading to SIRS. Sepsis complicated by dysfunction of an organ is called severe sepsis, which can evolve to septic shock, referred to as "hypotension caused by sepsis, persisting despite the appropriate level of fluids". The Task Force of 2001 [7] recognized restrictions by means of these definitions, but did not come up with an alternative proposal due to the lack of confirmation of support. They extended the list of diagnostic requirements, which resulted in the introduction of Sepsis-2. Therefore, to recognize sepsis according to the definition of Sepsis-2, as in the case of Sepsis-1, an individual must meet at least 2 SIRS criteria and have confirmed or suspected infection [6-8]. Therefore, the term of septic shock and sepsis remained unchanged for about twenty years. In 2016 as part of the SCCM (System Center Configuration Manager) / ESICM (European Society of Intensive Medicine) assessment of criteria for the identification of septic patients, this group compared traditional SIRS criteria with other methods, including the Logistic Organ Dysfunction System Score (LODS) and Sequential Organ Failure Assessment (SOFA). When analyzing these criteria, the authors recommended using the SOFA assessment to assess the severity of organ dysfunction in a potentially septic patient (Table 1). Validity of SIRS criteria and SOFA assessment for mortality in patients with sepsis were assessed by analyzing data from health records from the University of Pittsburgh and Kaiser Permanente databases [5]. Among critically ill patients

with suspected sepsis, the prognostic accuracy of the SOFA assessment for in-hospital mortality was better than the SIRS criteria. Patients who achieve SOFA score have a predicted mortality rate of $\geq 10\%$. SOFA is considered easier to calculate and was therefore recommended by the Task Force [3-5]. Other studies have confirmed that SIRS is not an ideal indicator of sepsis.

Table 1. Score system of Sequential Organ Failure Assessment (SOFA)^a

Body System	SOFAS cale				
	0	1	2	3	4
Respiratory system, PO ₂ / FiO ₂ , mmHg (kpa)	≥ 400 (53,3)	<400 (53,3)	<300 (40)	<200 (26,7) with assisted respiration	<100 (13,3) with respiratory system
Coagulation, number of platelets, $\times 10^3/\text{mm}^3$	≥ 150	<150	<100	<50	<20
Liver, bilirubin, mg/dL	<1.2	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardio-vascular system	MAP ≥ 70 mmHg	MAP <70 mmHg	Dopamine <5 or dobutamine (any dose) ^b	Dopamine 5.1-15 or epinephrine $\leq 0,1$ or noradrenaline $\leq 0,1^b$	Dopamine > 15 or epinephrine > 0,1 or noradrenaline > 0,1 ^b
Central Nervous System, GCS	15	13-14	10-12	6-9	<6
Kidneys, creatinine, mg /dL. Urine output, mL /d	<1,2	1.2-1.9	2.0-3.4	3.5-4.9 <500	>5.0 <200

^a, adapted after Vincent et al. [9]; ^b, catecholamine doses are given as $\mu\text{g} / \text{kg} / \text{min}$ for at least 1 hour. FiO₂, a fraction of inspired oxygen; MAP, mean arterial pressure; PO₂, partial pressure of oxygen.

The use of SOFA scale in clinical trials is routinely performed

and creates a popular element cumulating data for clinical trials at the intensive care unit (ICU). The multifaceted nature of the method, insufficient dataset for a large number of patients and the fear of late identification in conjunction with other methods, may cause troubles in use in clinical practice according to the Sepsis-3 method. Noting the real constraints, the SCCM / ESICM 2016 task group drew up an uncomplicated method called "quick SOFA" to facilitate the identification of patients presumably at risk of dying as a result

of sepsis [4-5]. This result is a transformed version of the SOFA (test regards the state of organ failure associated with sepsis). qSOFA consists of only three components, each of which is scored one point (Table 2). qSOFA score greater than or equal to two points indicates an organ dysfunction.

Table 2. Quick Sequential Organ Failure Assessment scale (qSOFA)

qSOFA criteria	Score
Respiratory rate ≥ 22 / min	1
Change in mental status (GCS)	1
Systolic blood pressure ≤ 100 mmHg	1

Using the quantitative assessment of qSOFA presumably results in the lack of early identification of sepsis, when the treatment is most effective. The prognostic value for in-hospital mortality between the SIRS criteria and the qSOFA score is still an area for open discussion. The qSOFA scale was created for quick assessment of patients outside ICU and can be successfully used in pre-hospital diagnosis, including in Emergency Medical Teams. The SOFA scale and its simplified version qSOFA are auxiliary devices that facilitate the diagnosis of sepsis or septic shock, and not the organs to be treated in these diseases. qSOFA can be used immediately without a blood test of a patient who is suspected of being infected. Diagnosing the patient with 2 out of 3 symptoms is a bad prognosis[1].

Application of the qSOFA scale in Emergency Medical Teams

„Emergency Medical Rescue teams both in Poland and worldwide encounter various medical cases in their professional work. In the Republic of Poland, Emergency Medical Teams are divided into 3 groups, i.e. :- "P" teams, standing for basic, consisting of at least two people entitled to perform medical emergency treatment, including a system nurse or a paramedic.

- "S" teams, specialized ones, which include at least three people authorized to perform medical emergency treatment, including a system doctor or a specialist, a system nurse and a paramedic.

- aviation team of the Helicopter Emergency Medical Service, which consists of at least three people, including a pilot, a system doctor and a paramedic or a system nurse.”

Pursuant to the provisions of the Law on State Emergency Medical Services, the governor of the province takes organizational measures aimed at providing the following parameters of the time of arrival at the scene for the emergency medical team from the moment the medical dispatcher receives the notification:

1. Monthly, median time of arrival is no more than 8 minutes in a city above 10,000 inhabitants and 15 minutes outside the city of over 10,000 residents;
2. Monthly, the third quartile of arrival time is no longer than 12 minutes in a city above 10,000 inhabitants and 20 minutes outside the city of over 10,000 residents;
3. Maximum time of arrival cannot be longer than 15 minutes in a city above 10,000 inhabitants and 20 minutes outside the city of over 10,000 inhabitants [3].

The work of a paramedic requires the ability to take quick and, above all, accurate decisions frequently in stressful situations. During the call, the priority for all members of any kind of team is to save human life. Sepsis is one of the most dangerous diseases, where the symptoms are not always clear. The use of a simplified version of Quick SOFA in medical rescue teams allows quick identification of victims with suspected infection and implementation of treatment in the pre-hospital phase. It is a simpler tool for the identification of risk in patients with symptoms or suspected infection, it may be particularly useful outside the ICU, in hospital departments, in A&E and outside the hospital. However, qSOFA is not used to diagnose sepsis. In patients with infections, 2 elements of qSOFA indicate an increased risk of ICU stay above 3 days and death during the hospital stay.

Summary

The introduction of the definition of Sepsis-3 is still relatively new in the critical care literature. Thus, given the ease of calculating the SOFA and the high characteristics of the SOFA / qSOFA results, it is likely to be adopted as a consensus definition for further clinical trials. However, as emphasized by Williams et al. [13], one of the limitations of the definition is low sensitivity of the qSOFA score system, which presumably eliminates its use to detect the early stage of sepsis, at the stage where the therapy is most effective. Despite the fact that the SOFA score has the highest prognosis accuracy for in-hospital mortality, one SIRS criterion or qSOFA score has a significant prognostic mortality accuracy, which is not specified and requires more testing. In addition, a large number of healthcare facilities

currently apply to the previous definition of sepsis, and the implementation of new recommendations will require funding to facilitate the change of protocols and the retraining of healthcare providers [17].

Conclusions

Although qSOFA may be valuable in predicting mortality associated with sepsis, it acts poorly as a screening tool to identify sepsis in Emergency Medical Teams. Relying solely on qSOFA may delay the initiation of evidence-based interventions known to improve sepsis-related results.

Further research on the use of the qSOFA scale is recommended in pre-hospital conditions.

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