Awareness and knowledge of sepsis in the general Korean population: comparison with the awareness and knowledge of acute myocardial infarction and stroke

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Objective Patients with severe sepsis or septic shock require timely, aggressive management to improve their outcomes, and early presentation of patients to the hospital may also be important. Thus, public awareness about sepsis may be important for improved outcomes. However, there are no studies regarding the public awareness of sepsis in the general Korean population. Therefore, the objective of this survey was to gain insight into the public awareness of sepsis.

Methods Prospective paper-based and web-based surveys were issued between May and June 2013 to adults aged ≥18 years.

Results A total of 1,081 participants responded to the survey (394 paper-based and 687 web-based). Mean age was 38.7 ± 11.4 years, and 541 participants (50%) were men. Of the 1,081 participants, 831 (76.9%) had heard of the term "sepsis." Of these participants, only 295 (35%) responded correctly regarding the definition of sepsis. However, 1,019 participants (94.3%) had heard of acute myocardial infarction, and 817 of these (80%) correctly defined acute myocardial infarction. Regarding stroke, 1,047 (96.9%) had heard of stroke, and 975 of these responded (93.1%) correctly to the definition of stroke.

Conclusion There is poor public awareness about sepsis compared with that of acute myocardial infarction and stroke. This may limit the timely management of severe sepsis and septic shock.

Keywords Sepsis; Knowledge; Awareness; Septic shock

Capsule Summary

What is already known
Previous surveys in the United States and European countries reported that sepsis awareness of general population was low. However, the current status of Korean population was not known.

What is new in the current study
In general Korean population, the awareness and knowledge about sepsis was significantly poorer than that of acute myocardial infarction and stroke.

INTRODUCTION

Sepsis is a potentially life threatening condition with an overall mortality rate as high as 30%–40%[1,2] and is a leading cause of death in critically ill patients.[3] To reduce the global sepsis-related mortality, the Surviving Sepsis Campaign was launched in 2002[4] with guidelines for the care of sepsis, which have been revised twice.[5-7] The most recent guidelines recommend timely interventions, which include measurement of lactate level, collection of blood cultures, and administration of antibiotics and crystalloid within 3 hours in addition to the achievement of mean arterial pressure ≥ 65 mmHg, measurement of central venous pressure, and measurement of central venous oxygen saturation in the event of persistent hypotension or initial tissue hypoperfusion within 6 hours.[7] Although these timeframes are expected to improve outcomes, the timing of presentation to the hospital is likely more important in patients with sepsis.

To facilitate the early presentation of patients to the hospital, public awareness and knowledge may be important. Acute myocardial infarction (AMI) and stroke are also diseases that require timely presentation to hospital and early interventions for appropriate treatment. For these reasons, cardiologists and neurologists have made efforts to improve public awareness about the early symptoms and diseases themselves for many years. Although these efforts have not always been successful, it is estimated that public awareness of these diseases has increased[8-10] and mortality rates have decreased.[11,12]

In contrast, public awareness of sepsis is reportedly low. An international survey on sepsis awareness reported that 47%–96% of the general population in the United States and European countries (France, Germany, Italy, Spain, and the United Kingdom) had never heard of the term sepsis.[13] Moreover, the proportion of people that can accurately define sepsis is approximately 5%. Similarly, awareness of sepsis in the general Korean population may be expected to be low. To improve public awareness of sepsis, the status needs to be understood. Thus, we performed a survey to assess the awareness of sepsis in the general Korean population and to compare the results with the knowledge of AMI and stroke.

METHODS

The institutional review board approved this survey. The survey was conducted between May 1 and June 30, 2013 with adults aged ≥ 18 years in Korea. Paper-based and web-based surveys were conducted.

Korea is a single race country. Therefore, the survey was developed using standard Korean language. The questionnaire was modified from a previous international survey by Rubulotta et al.[13] All of the questions, except those regarding demographic characteristics, were multiple choice. The surveys consisted of 6 questions regarding the awareness and knowledge of sepsis, AMI, and stroke (Appendix 1).

Two survey methods were conducted using the same questionnaire. A paper-based questionnaire was conducted with healthy guardians who visited the emergency department during the study period in 1 of 2 hospitals (Seoul National University Bundang Hospital, Seongnam, Korea and Gyeongsang National University Hospital, Jinju, Korea). Both hospitals are tertiary academic medical centers in Korea. The paper-based survey was conducted by study nurses or researchers in the hospital, who approached the healthy guardians to participate after explaining the survey. Following informed consent, the participants were provided the questionnaire. All participants returned the paper-based survey to the investigators. Web-based questionnaires were administered through the Internet Survey Company in Korea (Research Panel Asia Korea Inc., Seoul, Korea). The company sent an e-mail with a web-survey link requesting participation to 1,000 randomly selected people from a pool of prescreened respondents' e-mail addresses.

All data from the two survey methods were merged. Categorical variables are expressed as number (%). Chi-square tests were performed to compare the differences in awareness and knowledge between sepsis and AMI or stroke. Statistical analyses were performed using STATA ver. 10.0/IC (StataCorp LP, College Station, TX, USA). P-values < 0.05 were considered statistically significant.

RESULTS

Of the 1,081 participants who responded to the survey, 394 responded by paper and 687 by web. The mean age of the participants was 38.7 ± 11.4 years, and 541 participants (50.0%) were men. The educational level, occupation, and income of the participants are shown in Table 1.

Awareness and knowledge of sepsis, AMI, and stroke in the general Korean population

Of the 1,081 participants, 831 (76.9%) had heard of the term sepsis. Of these, 295 (35.0%) knew the correct definition of sepsis. Thus, the overall awareness of sepsis in the general Korean population was 27.3% (295/1,081). Of the 831 respondents who had heard of the term sepsis, 601 (72.3%) had heard the term sepsis from public media/internet. In addition, of the 831 respondents who had heard of the term sepsis, 114 participants (10.5%) thought that sepsis is a transmitted disease, and 191 (17.7%) responded that they had no knowledge of transmissibility (Table 2).

Table 1. Demographic characteristics of study participants responding to a questionnaire regarding the knowledge and awareness of sepsis

Variable	Category	Study respondents (n = 1,081)
Age (yr)	≤ 19	13 (1.2)
	20–29	293 (27.1)
	30–39	283 (26.2)
	40–49	282 (26.1)
	50–59	171 (15.8)
	≥ 60	39 (3.6)
Sex	Male	541 (50.0)
	Female	532 (49.0)
	No response	8 (1.0)
Education	≤ Middle school graduate	20 (1.9)
	High school graduate	217 (20.1)
	University- or college-student or graduate	745 (68.9)
	Postgraduate	98 (9.1)
	No response	1 (0.1)

Values are presented as number (%).

In contrast, 1,019 participants (94.3%) had heard of the term AMI, and 817 of 1,019 participants (80%) knew the exact definition of AMI. In addition, 1,047 participants (96.9%) had heard of the term stroke, and 975 of 1,047 participants (93.1%) knew the definition of stroke. This was significantly higher than the awareness and knowledge of sepsis in the general Korean population (chi-square test, $P < 0.05$) (Fig. 1).

Perceptions about the seriousness of sepsis

To assess the perceptions about the seriousness of sepsis in the general Korean population, a question comparing the mortality between severe sepsis/septic shock and other well-known diseases (AMI, cardiac arrest, stroke, stomach cancer, lung cancer, and trauma) was asked (Appendix, question 5), and 646 participants (59.8%) and 444 participants (41.1%) responded that AMI and stroke have higher mortalities than sepsis, respectively, and 690 participants (63.8%) responded that cardiac arrest has a higher mortality than sepsis (Fig. 2).

DISCUSSION

The results of this survey indicate that the awareness and knowledge of sepsis are poor compared with those of AMI and stroke in the general Korean population. Although mortality and severity were dependent on individual cases, the perception of the general Korean population regarding the seriousness of sepsis, as described by mortality, underestimated the actual sepsis-related mortality.

In this survey, only 27.3% of the participants knew the exact definition of sepsis. Early recognition of sepsis is important for early presentation to hospital. Sepsis is defined as a range of con-

ditions from systemic inflammatory response syndrome (SIRS) to localized infection; SIRS is diagnosed when ≥ 2 of the following criteria are met: abnormal body temperature, heart rate, respiratory rate or blood gas, or white blood cell count.[14] These diagnostic criteria are somewhat non-specific and may not be easily understood by laypersons. Furthermore, it has been reported that even physicians who care for critically ill patients in Europe and the United States are not able to define sepsis according to the above criteria.[15] Thus, the general public might not be expected to define sepsis. However, the general public should be aware that a simple localized infection can progress to sepsis, resulting in severe morbidity and mortality. In addition, the most common answer to the question regarding the definition of sepsis was systemic poisoning by raw fish or shellfish ingestion. The public media has reported fatal cases of vibrio vulnificus infection and issued a warning for people in Korea who may eat raw fish/shellfish. In this communication, the correct meaning of sepsis might not have been delivered to the general population. Therefore, some members of the population might believe that sepsis is a kind of food poisoning from raw fish/shellfish ingestion. The second most frequent incorrect answer was pulmonary hemorrhage. This might be related with the translation of the term sepsis into the Korean language. The Korean word for sepsis is borrowed from the Chinese character "敗血症 (Korean, 패혈증; pronounced as [pæ hyeol jeung])." "敗(패)" is pronounced as "[pæ]" and means rotten, "血(Korean, 혈)" is pronounced as "[hyeol]" and means blood or hemorrhage, and "症(Korean, 증)" is pronounced as "[jeung]" and means symptom or disease. However, the Korean word "패 [pæ]" is somewhat confused with the pronunciation of "폐 (means lung; Chinese character, 肺; pronounced as [pæ]). Thus, when the general population hears the pronunciation of "[pæ hyeol jeung]" without prior medical knowledge, "패혈증 (sepsis)" could be confused with "폐혈증(lung hemorrhage disease)."

AMI and stroke are representative diseases requiring timely, aggressive, and efficient management. Although it is unknown if public awareness has led to improved outcomes for these diseases, it may reduce delays and contribute to improved outcomes. Previous studies have reported that the public awareness of AMI and stroke is associated with reduced delays in presenting to hospital.[10,16,17] In the present survey, awareness of sepsis in the general public was significantly poorer than that of AMI or stroke. Considering sepsis is associated with greater mortality than AMI or stroke, public education for sepsis is needed to decrease delays in the presentation of patients with sepsis to the hospital.

In this study, 40%–60% of participants thought that the mortality associated with severe sepsis is lower than that of AMI or stroke. It is true that AMI and stroke are significant healthcare

Table 2. Results of a questionnaire regarding sepsis, acute myocardial infarction (AMI), and stroke in the general Korean population

| Choice	Response (%)
Q1. Have you heard of the term sepsis?	1,081
Yes	831 (76.9)
No	137 (12.7)
No idea	113 (10.5)
Q1a. How do you define the term sepsis?	831 (who answered 'yes' in Q1)
Severe allergic reaction	21 (3.0)
Systemic poisoning by raw fish/shell ingestion	323 (38.9)
Severe systemic inflammatory response by infection	295 (35.0)
Pulmonary hemorrhage	162 (19.0)
No idea	29 (3.0)
No response	1 (0.0)
Q1b. What is the source of information about the term sepsis?	831 (who answered 'yes' in Q1)
School	39 (4.7)
Hospital (or medical personnel)	39 (4.7)
Relatives/family/friends	71 (8.5)
Public media/Internet	605 (72.3)
Experienced by self or relatives	28 (3.3)
Already knew sepsis because of health care-related jobs	8 (1.0)
Others	37 (4.4)
No idea	10 (1.2)
Q2. Do you think that sepsis is a transmitted disease?	1,081
Yes	114 (10.5)
No	775 (71.7)
No idea	191 (17.7)
No response	1 (0.1)
Q3. Have you heard of the term AMI?	1,081
Yes	1,019 (94.3)
No	23 (2.1)
No idea	39 (3.6)
Q3a. How do you define the term AMI?	1,019 (who answered 'yes' in Q3)
Irregular heart beats	97 (10.0)
Slow heart beats	17 (2.0)
Rapid heart beats	36 (4.0)
Death of heart tissues due to occlusion of heart blood vessels	817 (80.0)
Inflammation of heart muscles	6 (1.0)
Others	31 (3.0)
No idea	15 (1.0)
Q4. Have you heard of the term stroke?	1,081
Yes	1,047 (96.9)
No	17 (1.6)
No idea	17 (1.6)
Q4a. How do you define the term stroke?	1,047 (who answered 'yes' in Q4)
Inflammation of brain	15 (1.4)
Brain dysfunction due to occlusion or rupture of blood vessels	975 (93.1)
Traumatic injury of brain	36 (3.4)
A kind of brain tumor	9 (0.9)
Others	8 (0.8)
No idea	4 (0.4)
Q5. Which is higher mortality than severe sepsis or septic shock? Please check all	1,081 (no. of participants who check "O")
Acute myocardial infarction O ( ) / X ( )	646 (59.8)
Cardiac arrest O ( ) / X ( )	690 (63.8)
Stroke O ( ) / X ( )	444 (41.1)
Stomach cancer O ( ) / X ( )	194 (17.9)
Lung cancer O ( ) / X ( )	222 (20.5)
Trauma O ( ) / X ( )	57 (5.3)
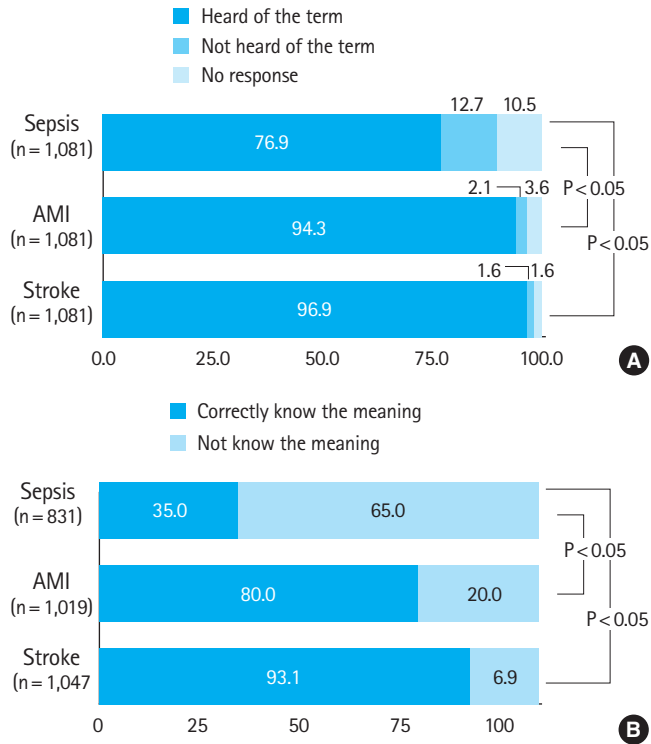
Fig. 1. Public awareness of sepsis, acute myocardial infarction (AMI), and stroke.

Fig. 2. Perception of the general public about the seriousness of sepsis regarding mortality. AMI, acute myocardial infarction.

problems. However, the mortality related with these diseases is gradually decreasing worldwide, including in Korea.[18,19] Although the overall in-hospital fatalities from severe sepsis have also decreased over time, the incidence and total mortality of severe sepsis or septic shock has increased,[20,21] and the mortality rate from sepsis is estimated to be higher than that of AMI or stroke.[22-24] Public awareness regarding the seriousness of sepsis is important for public action. Thus, education of the high mortality of sepsis for the general population may be warranted.

To improve the public awareness of sepsis, public media/internet campaigns, education in schools, or education for patients and relatives, as conducted for AMI and stroke, may be useful.[10,25,26] Considering that the most common source of information about the term sepsis in the present survey was public media/internet, a public media/internet campaign regarding the correct meaning of sepsis and the seriousness of this syndrome may be the most effective method to educate the public. In addition, the Korean term for sepsis, which may be confused with pulmonary hemorrhage, may need to be changed for the public to easily understand the meaning.

AMI and stroke are characterized by certain signs and symptoms. However, some patients who have atypical symptoms and signs of AMI or stroke present to the hospital for fear that they may have AMI or stroke; in fact, some are diagnosed with AMI or
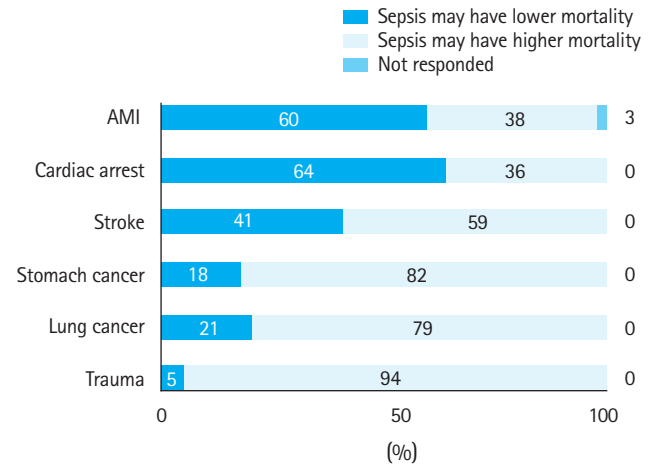
stroke. This may be owing to public awareness of those diseases. Although sepsis does not have specific signs and symptoms, the public should be aware that a simple infectious disease can progress to sepsis and mortality can be high in these cases. We believe that knowledge of the term "sepsis" can help improve public awareness because most of the public already knew the systemic manifestations of a simple infectious disease (e.g., fever, malaise, mental changes, dehydration, and shortness of breath).

This study has several limitations. First, selection bias may be present. The survey was conducted with guardians who visited the emergency department in 1 of 2 hospitals and a randomly selected sample for the web-based survey. Guardians of patients could be more exposed to the term "sepsis"; in addition, participants also reported higher educational levels and were of a younger age than the general Korean population. Therefore, the sample may not be representative of the general Korean population. However, given the differences between this sample and the general Korean population, the awareness and knowledge of sepsis in the overall Korean population may be expected to be poorer than the present results indicate. Second, this study used 2 survey methods to administer the same questionnaire. The paper-based survey was conducted with healthy guardians in the hospital, and the web-based survey was conducted with randomly selected members of the general population; this may have resulted in differences of knowledge regarding the medical term sepsis. However, in our preliminary analysis (data not included in this manuscript), there were no differences between the paper-based and web-based surveys. Of the 687 respondents to the web-based survey, 540 (78.6%) had heard of the term sepsis, whereas 291 of 394 respondents of the paper-based survey (73.9%) had heard of the term sepsis (chi-square, P = 0.191). Moreover, sepsis awareness (knowledge of the definition of the term sepsis) was 26.2% (180/687) in

the web-based survey and 29.2% (115/394) in the paper-based survey (chi-square, P = 0.289). Therefore, there were no differences in the awareness between the 2 surveys. Third, a multiple choice question was used to identify the definition of sepsis. Thus, some participants might have chosen the correct answer for this question without any real knowledge of sepsis. If the question regarding the definition of sepsis was asked directly without the multiple choices, the response rate of the correct answer might have been lower.

In conclusion, public awareness and knowledge regarding sepsis are poor compared with those for AMI and stroke in the general Korean population. This may limit the timely management of severe sepsis and septic shock.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENTS

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Appendix 1. Survey questionnaire

1. "Have you heard of the term sepsis?"
    1) Yes → go to question 1a & 1b
    2) No → go to question 2
    3) No idea → go to question 2
      (Only respondents who answered yes were directed to additional questions 1a and 1b while those who answered no were directed to the question 2.)

1a. "How do you define the term sepsis?"
    1) Severe allergic reaction
    2) Systemic poisoning by raw fish/shell ingestion
    3) Severe systemic inflammatory response by infection
    4) Pulmonary hemorrhage
    5) No idea

1b. "What is the source of information about the term sepsis?"
    1) School
    2) Hospital (or medical personnel)
    3) Relatives/Family/Friends
    4) Public media/Internet
    5) Experienced by self or relatives
    6) Already knew sepsis because of medical/healthcare-related jobs
    7) Others: (   )
    8) No idea

2. "Do you think that the sepsis is a transmitted disease?"
    1) Yes
    2) No
    3) No idea

3. "Have you heard of the term acute myocardial infarction?"
    1) Yes → go to question 3a
    2) No → go to question 4
    3) No idea → go to question 4
     Respondents who answered yes were directed to additional question 3a while others were directed to question 4.

3a. "How do you define the term acute myocardial infarction?"
    1) Irregular heart beats
    2) Slow heart beats
    3) Rapid heart beats
    4) Death of heart cells or tissues due to occlusion of heart blood vessels
    5) Inflammation of heart
    6) Others: (   )
    7) No idea

4. "Have you heard of the term stroke?"
    1) Yes → go to question 4a
    2) No → go to question 5
    3) No idea → go to question 5
     Respondents who answered yes were directed to additional question 4a while others were directed to question 5.

4a. " How do you define the term stroke?"
    1) Inflammation of brain
    2) Brain dysfunction due to occlusion or rupture of blood vessels of brain
    3) Traumatic injury of brain
    4) A kind of Brain tumor
    5) Others: (   )
    6) No idea

5. "Which is higher mortality than severe sepsis or septic shock? Please check all."
    i) acute myocardial infarction   O ( ) / X ( )
    ii) cardiac arrest   O ( ) / X ( )
    iii) stroke   O ( ) / X ( )
    iv) stomach cancer   O ( ) / X ( )
    v) lung cancer   O ( ) / X ( )
    vi) trauma   O ( ) / X ( )