

Knowledge regarding assessment of sepsis among Greek nurses

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Abstract

The aim of the present survey was to evaluate nurses' knowledge regarding sepsis in Greece. A total of 835 registered nurses (125 males/710 females) from tertiary hospitals in Greece were interviewed from April 2008 to December 2009. All participants completed a self-completed questionnaire about assessment of sepsis (see Figure 1). Basic demographic information was recorded. The protocol and questionnaire were approved by the Ethics Committees of participating hospitals. The majority of the participants answered correctly regarding awareness of systemic inflammation – 83.5% regarding the role of temperature in the definition of systemic inflammation; 81.3% regarding the importance of white blood cell count; and 49.9% and 46.3% regarding the role of tachycardia and tachypnoea, respectively. The same pattern was observed regarding the answers about the assessment of sepsis – 79.4% of the nurses answered correctly about the role of blood pressure; 70.9% about the role of urine volume; and 43.5% about the importance of oxygen saturation. Finally, 57.2% of the participants confirmed that in practice they followed the current guidelines for the diagnosis and treatment of patients with sepsis. The study has established baseline data with which future studies can be compared.

Introduction

Sepsis is one of the leading causes of death worldwide and has considerable impact on the quality of life and on global health

economics (Padkin et al., 2003; Picard et al., 2006). It is a complex entity that is traditionally conceived as an intense inflammatory response of the host to an infectious stimulus leading to deterioration of organ function and ultimate death (Picard et al., 2006). In 1991, a conference was held by the American College of Chest Physicians (ACCP) and the Society of Critical Care Medicine (SCCM) to provide a definition of the systemic inflammatory response to infection in order to facilitate diagnosis (ACCP–SCCM, 1992). *Infection is a pathologic process caused by the invasion of normally sterile tissue or fluid by pathogenic or potentially pathogenic micro-organisms.* Sepsis is the presence of infection, documented or strongly suspected, with a systemic inflammatory response, as indicated by the presence of some of the following features –body temperature greater than 38°C or less than 36°C, heart rate greater than 90 beats/min, respiratory rate greater than 20 breaths/min or hyperventilation with a PaCO₂ less than 32 mmHg, white blood cell count >12,000/mm³, <4,000/mm³, or with >10% immature neutrophils. Severe sepsis is sepsis complicated by organ dysfunction, hypoperfusion, or hypotension, while septic shock is the severe sepsis complicated by acute circulatory failure characterised by persistent arterial hypotension, despite adequate volume resuscitation, and unexplained by other causes (ACCP–SCCM, 1992).

Despite recent advances in critical care, sepsis affects more than 750,000 patients and accounts for 215,000 deaths in the USA alone each year, at a cost of more than \$16 billion (Picard et al., 2006). In addition, patients with severe sepsis are using 45% of all intensive

Questionnaire

The role of nurses in the recognition of early signs of sepsis hospitalised patients is essential and contributes to early clinical diagnosis and thereby reduces rates of complications, mortality and health care costs.

The following questionnaire is intended to detect the knowledge of nurses in Greek hospitals.

(Please answer all questions)

1. The active participation of nurses in medical care team's discussions about sepsis is essential
 True False I don't know
2. Nurses should be continually updated with lectures/workshops/conferences/seminars about sepsis
 True False I don't know
3. The application of new data regarding the prevention and treatment of sepsis is **used** in the daily practice
 True False I don't know
4. Which of the following is/are in the definition of systemic inflammatory response:
(put in circle)
 - a. Body temperature >38°C or body temperature <36° C
 - b. Tachycardia
 - c. Tachypnoea
 - d. White cell count >12,000/mm³
5. Patients in septic shock have hypotension despite intravascular volume restoration with fluids.
 True False I don't know
6. When I notice that the patient fulfils the criteria of sepsis, I should inform my colleagues directly and precisely
 True False I don't know
7. Which of the following sign/s, increase/s the suspicion of a patient in sepsis:
(put in circle)
 - a. The fall in of mean arterial pressure <70mmHg
 - b. Blood glucose >120 mg / dL in non-diabetic patient
 - c. Reduction of hourly urine excretion
 - d. Increased Fe and serum ferritin
 - e. Oxygen saturation's fall
8. Signs such as vomiting, diarrhoea, gastroparesis, ileum may be an early sign of organ dysfunction
 True False I don't know
9. I consider that my patient has the septic syndrome, when the level of consciousness alters
 True False I don't know
10. The scoring assessing system for sepsis is used in daily practice in my working place
 True False I don't know

Figure 1. Self-completed questionnaire

care unit (ICU) bed days and 33% of all the hospital bed days (Padkin et al., 2003).

Early recognition of a patient with sepsis is the main key to successful management (Rivers et al., 2005; Kumar et al., 2006a). Studies have shown that compliance with evidence-based guidelines for the treatment of sepsis within the first hour from diagnosis can have a dramatic effect on survival (Bone et al., 1992; Rivers et al., 2001). Nurses at the bedside are in a unique position to use their expertise to quickly detect the subtle initial symptoms and signs of sepsis. It is important that nurses are well trained to recognise patients with sepsis and adhere to guidelines in order to treat them promptly (Robson et al., 2007). Successful management of the patient with septic shock relies on the early commencement of therapy i.e. within less than one hour from the advent of hypotension (Kumar et al., 2006b); achievement of this goal is based largely on the proficiency of the nursing team.

However, it is reported that nurses' knowledge regarding assessment of sepsis and current therapeutic guidelines is limited (Robson et al., 2007). The aim of the present study was to evaluate nurses' knowledge about assessment and management of sepsis in Greek hospitals. Therefore the research question was 'Do nurses have the knowledge to assess and manage patients with sepsis?'

Methods

Sample and setting

In order to answer the research question we conducted a survey with a self-completed questionnaire with a section for basic demographic characteristics of study participants and a second section with closed responses for the evaluation of nurses' knowledge regarding the assessment and management of sepsis.

Nurses from major tertiary hospitals of Greece were asked to complete and return to study staff the self-completed questionnaire between April 2008 and December 2009. A total of 14 hospitals were selected according to the method of random sampling nationwide. Participants were registered nurses working at tertiary hospitals for at least one year. Registered nurses working less than a year and nurse assistants were excluded from the study. In order to avoid possible selection bias and achieve representativeness, all nurses at the above hospitals were asked to complete a self-administered questionnaire where confidentiality and anonymity were maintained. In total, 928 nurses were asked to complete the questionnaire; 93 nurses refused to complete the questionnaire. Refusal rate was 10% (no information for the potential reasons for nurses' refusal to participate was available).

The study was conducted in accordance with the 2004 amendment of the Declaration of Helsinki, the guidelines for Good Epidemiological

Practice and local regulatory requirements (IEA, 2007). The protocol and questionnaire were approved by the Ethics Committees of participating hospitals.

Instruments and procedure

All study participants, in an interview setting, were asked to complete a questionnaire designed to assess knowledge of sepsis definitions and management guidelines. The questionnaire was designed by three expert nurses and three physician experts who were actively participating in the research steering committee of the Hellenic Sepsis Study Group (www.sepsis.gr) according to questionnaires that have been used in previous studies assessing the same question (Ziglam et al., 2006; Robson et al., 2007). The questionnaire addresses questions related to (a) the possibility of recognising signs and symptoms of sepsis ('true' and 'false' answers); (b) the current nurses' attitude about the sepsis epidemic; and (c) providing opinion about the prevalence and diagnosis of sepsis syndrome in Greek hospitals.

Data analysis

Statistical analysis was performed using programs available in the SPSS statistical package (SPSS 15.0, Chicago, USA). Data were analysed and results provided as frequencies in percentages. Two sub-groups for the analysis of the data were created; the first according to educational level (university vs. technological education) and the second according to nurse's working position (ICU vs. non-ICU personnel). Comparisons between groups were performed by chi square test. Any value of *P* below 0.05 was considered statistically significant.

Results

A total of 835 registered nurses participated in the study (125 males/710 females); 74.8% (*n*=625) of participants were working at general hospitals, 22.6% (*n*=189) at military hospitals and the rest of them at cancer treatment hospitals 2.6% (*n*=21); 17.4% (*n*=145) of the nurses were working in ICUs, 35.4% (*n*=296) at surgery departments, 21.3% (*n*=178) at internal medicine units and 25.9% (*n*=216) at other hospital units (mainly neurosurgery, cardiology, nephrology and orthopaedic departments). Of the study participants 21.9% (*n*=183) had graduated from university departments, 71.8% (*n*=599) from technological institutes (colleges) and 6.3 (*n*=53) from the military academy of nursing. Because of the small number of military nurses their answers were not compared with university and technological institutes' graduates.

Knowledge of systemic inflammatory response syndrome

The first set of questions measured the participants' knowledge of the clinical characteristics of the systemic inflammatory response. 83.5% (*n*=697) of the study participants answered that temperature higher than 38°C or lower than 36°C was compatible with systemic inflammatory response. In addition, 81.3% (*n*=679) answered correctly regarding white blood cell count as a component of systemic inflammation. Similar correct answers for tachycardia and tachypnoea were provided by 49.9% (*n*=417) and 46.3% (*n*=387), respectively (Table 1).

It is important to denote that significant differences were observed between nurses according to educational level (university vs. college) regarding tachycardia 65.6% (*n*=120) vs. 45.4% (*n*=272) respectively, *p*<0.001, tachypnoea 57.9% (*n*=106) vs. 43.6% (*n*=261), respectively, *p*=0.001 and increased white blood cell count as symptoms of systemic inflammation (86.9% (*n*=159) vs. 79.8% (*n*=478), respectively, *p*=0.03) (Table 1). In addition, significant differences were observed between nurses according to working units (ICU vs. non-ICU personnel) regarding tachycardia 60.7% (*n*=88) vs. 47.7% (*n*=329), respectively, *p*=0.004 (Table 1). No significant differences were observed for the rest of the tested parameters between the two study sub-populations.

Table 1. Correct answers regarding awareness of systemic inflammation and sepsis in the total study population and sub-populations according to education level and working in ICU or not

	Study population <i>n</i> =835 (%)	University Education <i>n</i> =183 (%)	Technological Educational Institute <i>n</i> =599 (%)	<i>p</i> value university/ technological education	ICU personnel <i>n</i> =145 (%)	Non-ICU personnel <i>n</i> =690 (%)	<i>p</i> value ICU/ Non - ICU personnel
Signs of systemic inflammation							
Body temperature >38°C or <36°C	697 (83.5)	145 (79.2)	505 (84.3)	NS	126 (86.9)	566 (82.8)	NS
Tachycardia	417 (49.9)	120 (65.6)	272 (45.4)	<i>p</i> <0.001	88 (60.7)	329 (47.7)	<i>p</i> =0.004
Tachypnoea	387 (46.3)	106 (57.9)	261 (43.6)	<i>p</i> =0.001	72 (49.7)	329 (47.7)	NS
White cells count >12,000/mm ³	679 (81.3)	159 (86.9)	478 (79.8)	<i>p</i> =0.03	118 (81.4)	561 (81.3)	NS
Signs of severe sepsis							
Mean arterial blood pressure <70 mmHg	663 (79.4)	147 (80.3)	475 (79.3)	NS	124 (85.5)	539 (78.1)	<i>p</i> =0.04
Plasma glucose >120 mg/dL in non-diabetic patient	194 (23.2)	50 (27.3)	133 (22.2)	NS	42 (29.0)	152 (22.0)	NS
Reduced urine excretion per hour	592 (70.9)	127 (69.4)	426 (71.1)	NS	106 (73.1)	486 (70.4)	NS
Increased serum Fe and ferritin levels	75 (9.0)	15 (8.2)	54 (9.0)	NS	13 (9.0)	62 (9.0)	NS
Oxygen saturation <92%	362 (43.5)	80 (43.7)	259 (43.3)	NS	71 (49.0)	292 (42.3)	NS

Table 2. Correct answers regarding knowledge of sepsis in the total study population and sub-populations according to education level and working in ICU or not

	Study population n=835 (%)	University education n=183 (%)	Technological Educational Institute n=599 (%)	p value university / technological education	ICU personnel n=145 (%)	Non-ICU personnel n=690 (%)	p value ICU/ Non-ICU personnel
The active participation of nurses within medical care team discussions about sepsis is essential	746 (90.0)	158 (86.3)	540 (90.5)	NS	122 (84.7)	624 (90.4)	p=0.02
Nurses should be continually updated with lectures/workshops/conferences/seminars on sepsis	803 (96.5)	172 (94.0)	578 (97.0)	NS	137 (94.5)	668 (96.8)	NS
When I notice the criteria of sepsis for a patient I should immediately inform my medical colleagues in a direct and precise way	797 (96.2)	174 (95.1)	574 (96.1)	NS	135 (93.1)	664 (96.2)	p=0.04
Application of new data regarding the prevention and treatment of sepsis is in daily practice	470 (57.2)	76 (41.8)	361 (60.9)	p<0.001	85 (59.9)	387 (56.1)	NS

Awareness of sepsis. Some of the nurses (79.4% (n=663)) answered that mean blood pressure lower than 70 mmHg is compatible with septic shock. In addition, 70.9% (n=592) answered correctly regarding decrease in urinary output and 43.5% (n=362) answered correctly that decreased oxygen saturation could define severe sepsis. However, the correct answers about the importance of elevated plasma glucose and serum ferritin were low; 23.2% (n=194) and 9.0% (n=75), respectively (Table 1).

It is important to note that significant differences were observed between nurses according to working places (ICU vs. non-ICU personnel) regarding the role of mean arterial blood pressure 85.5% (n=124) vs. 78.1% (n=539), respectively, p=0.04 (Table 1). No significant differences were observed for the rest of the tested parameters between the two study sub-populations.

Knowledge of sepsis. About 57.2% (n=470) of the study participants attested that they were following the current guidelines for the diagnosis and treatment of patients with sepsis in their clinical practice. The majority of the participants 96.2% (n=797) agreed that communication with other hospital staff about the patient with sepsis should be immediate and accurate. In addition, 88.5% (n=739) of the nurses answered that antibiotic treatment starts early after the diagnosis of sepsis.

It is also important to note that half of the study participants (54.6%) (n=456) answered that they diagnosed a septic patient by the patient's level of consciousness. The majority (85.7%) (n=716) of the nurses answered that diarrhoea and vomiting are early markers of sepsis. Moreover, it is noteworthy that the majority of the participating nurses (96.5%) (n=803) emphasised the need for educational programmes regarding the current guidelines for sepsis (Table 2). However, nurses with a higher educational level apply the current guidelines for sepsis in daily practice less than nurses with lower educational level (41.8% (n=76) vs. 60.9% (n=361), p<0.001, respectively) (Table 2). It is noteworthy that 90.4% (n=624) of the non-ICU personnel (vs. 84.7% (n=122) of ICU personnel) believe that the active participation of nurses in the medical care team's discussions about sepsis is essential (p=0.02). Also, 96.2% (n=664) of the non-ICU personnel (vs. 93.1% (n=135) of ICU personnel) believe that it is of major importance to inform the rest of the medical staff directly and precisely about sepsis (p=0.04) (Table 2). No significant differences were observed for the rest of the tested parameters between the two study sub-populations.

Discussion

The results of the present study showed that knowledge of systemic inflammation and sepsis is only at a satisfactory level among Greek registered nurses both at college and university level and among ICU and non-ICU personnel. The study showed that the majority of Greek nurses can promptly identify systemic inflammation by temperature changes, increased or reduced white blood cell count, decreased mean blood pressure and decreased urine volume. However, only half of the sample was aware of the importance of tachycardia, tachypnoea, and decrease in urinary output and oxygen saturation for the diagnosis of sepsis and even fewer participants were aware of the significance of high levels of plasma glucose and ferritin in severe sepsis. So it seems that there is a need for continuous updating of educational programmes. The majority of the participating nurses have emphasised this need in the questionnaire.

A designated sepsis course is not included in the professional training curriculum of nurses in Greece, with the exception of a brief introduction to the septic syndrome within the course of ICU. The results of this survey underline this gap and indicate the necessity for a revision of the core nursing training schedule and the inclusion of dedicated sepsis training. The Hellenic Sepsis Study Group monitors septic syndrome in Greece with surveys, congresses and continuing

educational programmes, contributing to updating on new developments on the septic syndrome.

The importance of training courses has also been demonstrated by the study of Tromp et al (2009), which compared test results before and after the application of a sepsis teaching in training-grade doctors. It is worth noting that significantly higher results were sustained after four to six months (Tromp et al, 2009).

In addition 57.2% (n= 470) of the participating nurses confirmed that in their daily practice they were following the current guidelines for the diagnosis and treatment of patients with sepsis. It is an interesting finding that university graduates comply less with the guidelines and this could be an issue that needs to be explored.

The difference observed between nurses according to educational level regarding tachycardia, tachypnoea and increased white blood cell count as symptoms of systemic inflammation shows that university graduates might be able to recognise the symptoms of systemic inflammation at an earlier stage and might indicate that higher education is important for the quality of nursing care. Additionally the differences observed between nurses according to working places (ICU vs. non-ICU personnel) regarding the role of tachycardia and mean arterial blood pressure may also show the importance of expertise in earlier recognition of the signs of sepsis.

It is noteworthy that non-ICU personnel may have a more active stance in the multidisciplinary team, considering essential the role of nurses to inform the medical staff when they consider a patient at risk of sepsis and also to participate in the medical care team discussions about sepsis. This finding needs to be further explored as there is no evidence on different stances and roles of ICU and non-ICU nurses in Greece.

Only a few previous studies have described physicians' and nurses' knowledge regarding the assessment of sepsis, showing an inadequate level of knowledge of the signs and symptoms of sepsis (Poeze et al, 2004; Fernandez et al, 2006; Ziglam et al, 2006; Robson et al, 2007; Tromp et al, 2009).

The study of Robson et al (2007) enrolled 73 registered ward nurses of junior to senior grade and showed a general lack of knowledge regarding signs and symptoms such as hypothermia (22%), increased blood glucose in non-diabetic patients (43%), decreased systolic blood pressure (43%) and decreased oxygen saturation (46%) for the diagnosis of sepsis. Robson et al's (2007) study had a second phase which included a questionnaire with case studies that showed major deficits in the knowledge of sepsis among participants.

Another international survey, by Poeze et al (2004), included 1,058 physicians (an equal number of intensive care and other specialists) from France, Germany, Italy, Spain, the United Kingdom and the United States, showed a significant difference between health workers in ICUs and non-ICU personnel regarding the importance of monitoring in the diagnosis of sepsis as well as knowledge and agreement on the definitions of sepsis.

The same pattern was observed in a study by Tromp et al. (2009), which included physicians only. A total of 253 questionnaires were collected in three periods according to a teaching intervention

(before, three hours after the education session about sepsis and four to six months after) (Tromp et al, 2009). The majority of physicians had deficient knowledge of signs or symptoms of sepsis and stated that the diagnosis of sepsis is often missed (Tromp et al, 2009). It is also important to notice that there was no difference between scores or increase in score per gender or the year of training (Tromp et al, 2009).

Another study (Fernandez et al, 2006), where a validated questionnaire was given personally to 160 physicians, showed low physician knowledge about the role of blood glucose in sepsis (40.9%), the role of the use of steroids (32.5%) and ventilation (46%) in the management of a septic patient.

The study of Ziglam et al (2006) showed that knowledge regarding assessment of sepsis increased over time, when a group of residents in 1999 was compared with a different group in 2003 (55 training-grade doctors participated in this survey in 1999 and 78 in 2003). However, this study also showed that, despite an improvement in the second date, only 48% and 67.4% of the residents, respectively, could correctly define severe sepsis and shock (Ziglam et al, 2006).

There are some limitations to the present study. Firstly the questionnaire was not validated under a pilot study. Secondly the structure of the questionnaire with dichotomous 'true' or 'false' questions may have limited the validity of the survey. In addition, it must be mentioned that the design of the used questionnaire in the present study was not exhaustive for the assessment of septic patients. Finally, as data were collected by tertiary hospitals it is possible that they cannot be extrapolated to the total nurse population of the country. However this study could be used as a starting point to guide changes in undergraduate and professional education.

Conclusion

Nurses can have an advanced role in early recognition and treatment of septic patients that may be critical for their survival. The results of the present study showed that awareness of systemic inflammation and sepsis is only at a satisfactory level among Greek nurses. Seminars should be focused on the issues that need improvement. Research is also needed to evaluate nurses' awareness of sepsis internationally.

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