

KNOWLEDGE AND IDENTIFICATION OF SEPSIS AMONG PEDIATRIC NURSES AT NEONATAL INTENSIVE CARE UNITS

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ABSTRACT

Background: Sepsis is a common clinical syndrome associated with high mortality rate and considered one of the world's leading causes of death worldwide. Therefore, the aim of this study was to assess nurse's knowledge, and current practice of Systemic Inflammatory Response Syndrome, diagnostic criteria, sepsis guidelines and the importance of SIRS recognition. The study was conducted in the Neonatal Intensive Care Units at Menofia University Hospital and El Bagour Central Hospital. A descriptive exploratory design was used. A convenient sample of all nurses who were working in the above mentioned settings were selected (90 nurses) from January to September 2016. One tool was used for data collection consists from 5-parts questionnaire to assess nurses' knowledge. The results of this study revealed that there were knowledge deficit between nurses' about SIRS and sepsis. In conclusion, in-service educational programs are important to upgrade nurses' knowledge and level of performance to aid in recognizing earlier stages of sepsis to promote patients' recovery and improve quality of life.

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INTRODUCTION

Sepsis is associated with high mortality rate and constitutes one of the main causes of death. At least 19 million cases every year are diagnosed with sepsis and the majority in low- and middle-income countries (1&2). Mortality rates from sepsis range between 25% to 30% for severe sepsis and 40% to 70% for septic shock. The clinical presentation of sepsis is highly variable depending on the etiology. The most common sites of infection are the respiratory, genitourinary, and gastrointestinal systems, as well as the skin and soft tissue (3). These deaths caused by infectious causes such as neonatal sepsis, meningitis and pneumonia (4). It is the culmination of complex interactions between the infectious agent and the host immune, inflammatory and coagulation responses. Both the host responses and the characteristics of the infecting organism influence the outcome of sepsis (5).

Systemic inflammatory response syndrome is a collection of signs where body reacting to a range of injuries or illnesses (6). It is inflammatory state affecting the whole body. Frequently it is the result of the body immune response to infectious or non-infectious diseases (7). Health-care-associated infections (HCAIs) persists as a major problem in most in Egyptian Neonatal Intensive Care Units (NICUs) as infants do not have fully mature defense systems. Therefore, invasive procedures are more likely to result in the colonization of microorganisms than on adults. Surveillance studies have shown rates of infection in the NICU of 15% to 20% (8).

It is characterized by systemic inflammation and widespread tissue injury caused by infection. The severity of illness is ranging from sepsis, severe sepsis and septic shock. When infection is absent, the clinical syndrome is termed Systemic Inflammatory Response Syndrome (9). Sepsis is characterized by systemic signs of circulatory collapse such as poor peripheral perfusion, pallor, hypotonia and poor responsiveness (10). As well as temperature instability, increased oxygen demand, apnea, intercostal retraction, weak pulse, delayed capillary refill, hypotension, tachycardia, irritability, lethargy, hypotonia, abdominal distension and may progress to septic shock and DIC. Hematological indices, acute phase reactants, protein markers, and cytokines have been extensively examined as adjunctive tests for diagnosis of sepsis (11). Early recognition is crucial to improve patient's outcomes. The nursing assessment can note the subtle changes in a patient condition that signal early sepsis so, early treatment will improve patient outcomes (12).

Aims of initial management to secure the airway and correct hypoxemia. Intubation and mechanical ventilation may be required to stabilize patient's respiratory status (4). Steps in sepsis management were early triage and identification with rapid and appropriate fluid resuscitation in addition to blood cultures, antibiotic administration, and source control of infection finally close clinical and biomarker (lactate) monitoring. Much debate

continues on what elements or interventions should be used to care for persons with sepsis (13).

Death from sepsis syndrome from complication process with divergent factors such as overwhelming immune response and inflammatory reaction are major contributors to direct or indirect assaults on vital organs (14). The total number of patients admitted to NICU of Menofia university Hospital was 191 neonates and in Manshia Soltan Hospital were 200 neonates. In Menofia university Hospital, 106 neonates were males and 84 were females and In Manshia Soltan Hospital were 117 neonate's males while 83 were females (15). Nurses play a vital role in spotting symptoms and beginning a management plan that includes level of observation, review schedule and an escalation plan. Therefore, all nurses need to be aware of sepsis development (5).

Critical care nurses are the health care professionals who have the obligation to protect critically ill patients against infection especially that leading to sepsis, in order to promote patients' recovery and prevent deterioration in their health (9). Intensive care nurses play a critical role in the prevention, early detection and starting therapeutic interventions in patients with sepsis (16). Therefore, the purpose of this study was to evaluate nurse's knowledge, current practice of SIRS diagnostic criteria, sepsis guidelines and the importance of SIRS recognition.

Aim of the study

The aim of this study was to assess nurse's knowledge, current practice of SIRS diagnostic criteria, sepsis guidelines and the importance of SIRS recognition. This aim was achieved through the following objective: Assessing nurse's knowledge, current practice of SIRS diagnostic criteria, sepsis guidelines and the importance of SIRS recognition

Research question

Are nurses knowledge about SIRS diagnostic criteria, sepsis guidelines and the importance of SIRS recognition is satisfactory?

Significance of the study

Sepsis remains the primary cause of death from infection despite advances in modern medicine including vaccines, antibiotics and intensive care. It is a life-threatening and complicated host response to the presence of infection that is affecting millions of individuals around the world each year (16). In Egypt, septicemia is considered the single most important cause of death accounting for up to 50% of neonatal mortality (9). According to the world health organization (WHO), Each year four million neonates die during the first month of life. Neonatal infections are currently the reason for about 1.6 million deaths per year in the developing world, and the first cause of newborn mortality is infection (17). Inadequate early sepsis identification is the primary barrier to effective interventions to prevent septic shock (5). More than 40% of under-five deaths globally occur in the neonatal period resulting in 3.1 million of newborn deaths each year (18).

Sepsis accounted for approximately 2% of hospitalizations; it made up 17% of hospital deaths. If left untreated, sepsis can lead to a multitude of complications, including multiple organ dysfunction and even death (19). Critical care nurses should have sound knowledge and strict adherence to sepsis bundle (20). Also, they are in an ideal position to ensure patients are reviewed, by increasing their own knowledge and awareness of sepsis,

thereby preventing deterioration into severe sepsis or septic shock. For every hour's delay in beginning treatment, a patient's risk of death increases by 7.6% (21).

Subjects and methods

Study design: A descriptive exploratory research design was utilized in this study.

Settings: The study was conducted at Neonatal Intensive Care Unit at Menofia University Hospital and El Bagour Central Hospital.

Sample: A convenience samples including 90 ICU nurses was recruited in the current study from January 2016 and lasted until September 2016.

Tool of the study

One tool was used for data collection. It was developed by (22). It consists from 5-parts questionnaire to assess nurse's knowledge related to sepsis. It comprised of the following parts:

Part one: includes demographic characteristics of studied nurses as age, sex, education, experience in NICU and previous training.

Part two: includes set of scenarios for nurses to indicate child was experiencing sepsis or not.

Part three: includes list of indicators were nurses select that indicate SIRS or sepsis or not sorted by correctly identified indicators (Yes/No). Thus, correct and incorrect answers were scored as 1 and if the participant did not know the answer, the score was 0.

Part four: includes Case studies sorted by correctly identified answer

Part five: includes 3-point Likert scale to determine nurses' attitudes towards the importance of SIRS recognition by using 3-item Likert scales (Strongly Agree, Neutral and Strongly Disagree).

Scoring system for nurse knowledge

Scoring system for knowledge of studied nurses was calculated as the following:

-The studied nurses answers were compared with a model key answer, where 1= correct answer, 0 = incorrect answer

-According to the nurses' response, their level of knowledge was categorized as the following:

Scoring system

Item	Score	Total score
Correct answer	1	> 60%
Incorrect answer	0	< 60%

Methods

Written permission

An official permission to carry out the study was obtained from the administrators of each setting after submitting an official letter from the dean of the Faculty of Nursing, Menofia University Hospital explaining the purpose of the study. Meeting was conducted first with the administrator of each setting to obtain permission for conducting research and explaining aim of the expected outcomes.

Tool development

It was developed by (22). It consists from 5-parts questionnaire. This tool was translated in Arabic language to assess nurse's knowledge, current practice of SIRS diagnostic criteria, sepsis guidelines and the importance of SIRS recognition

Protection of human rights

Nurses were informed about the privacy of their information; the study was voluntary, harmless. A formal consent was obtained, and confidentiality of responses would be respected.

Table (1) Demographic characteristics of studied group

Demographic data	Nurses				Statistical analysis
	Menofia University Hospital n=68		El Bagour Central Hospital n=22		
	No	%	No	%	
Education					Cramer V=.619
- Nursing Diploma	7	10.3	12	54.5	
-Technical nursing Institute	5	7.4	0	0	
- Bachelor degree	14	20.6	10	45.5	
Other	42	61.8	0	0	
Training program					Cramer V=.326
Yes	0	0	0	0	
No	68	100	22	100	
Age					Cramer V=.326
· 20-<	51	75	13	59.1	
· 25-<	8	11.8	8	36.4	
· 30<	8	11.8	0	0	
· 35-<	1	1.5	1	4.5	
· ≥40	0	0	0	0	

Data collection procedure

The researchers collected the data during the morning and afternoon shift at four days/week from 9 AM

Table 2: List of first set of scenarios for asking nurses to indicate child was experiencing sepsis or not

No	Scenario	Correct Answer	Responses (%)
1	Seven-year-old admitted to the floor for pneumonia. Temp - 38.7 degrees Celsius. HR - 160. RR - 35. BP - 112/68. O2 sat - 96% on room air. Productive cough. No retractions. Cap refill 2-3 seconds. White blood cell (WBC) count - 10.8. Playful. Rationale: Hyperthermia, tachycardia, and tachypnea present (3 of 4 SIRS criteria) with known infection (pneumonia).	Yes	Yes = 33.3 No = 66.7
2	Nine-month-old who presents to the emergency department with altered mental status. Temp - 36.2. HR - 150. RR - 38. BP - 80/40. O2 sat - 96% on room air. Cap refill 3 seconds. WBC - 6.1. Playful. Rationale: Temperature and WBC are within normal limits - SIRS not present.	No	Yes = 35.6 No = 64.4
3	Two-year-old who is being transferred outside emergency department to rule out appendicitis. Temp - 39. HR - 185. RR - 42. BP - 72/35. O2 sat - 90% on nonrebreather. Cap refill 5 seconds. Lethargic. Rationale: Hyperthermia, tachycardia, and tachypnea present (3 of 4 SIRS criteria) with suspected infection (rule-out appendicitis).	Yes	Yes =51.1 No =48.9
4	Twelve-year-old who has been on the general care ward overnight for altered mental status and suddenly has a seizure. After lorazepam (Ativan®) administration and awaiting transfer to the ICU, you check vital signs. Temp - 35.7. HR - 92. RR - 10. BP - 108/70. O2 sat - 93% on 100% FiO2 per non-rebreather. Cap refill 3 seconds. Rationale: Temperature is the only altered vital sign (only 1 of 4 SIRS criteria). There is no indicator of suspected/known infection.	No	Yes =18.9 No =81.1
5	Two-week-old infant being transported from outside hospital for increased work-of-breathing. Temp - 37.2. HR - 170. RR - 65. BP - 78/40. O2 sat - 87% on 100% FiO2 per blow-by. Cap refill 2 seconds. WBC - 5.1. Lethargic. Rationale: Temperature and WBC are within normal limits; therefore, SIRS cannot be present.	No	Yes =45.6 No = 54.4
6	15-year-old in the Intensive Care Unit (ICU) following a craniotomy. Temp - 37.5. HR - 110. RR - 34. BP - 115/82. O2 sat - 96% on room air. Cap refill 2 seconds. WBC - 16.8. Complains of headache. Rationale: Tachycardia, tachypnea, and elevated WBC are present (3 of 4 SIRS criteria) along with suspected infection (post-operative patient).	Yes	Yes = 47.8 No =52.2

Table 3: reported that the most identified indicators of sepsis are temperature great than 38.5 C (88.9%) , WBCs greater than 12 X 10³/mm³ (74.4%) and suspected

to 5 PM. The meeting went on for 20-30 minutes from January to September 2016.

Eligibility Criteria

1. Inclusion Criteria

All staff nurses working in the 2 selected hospitals (Menoufia University Hospital and El Bagour Central hospital) who were willing to participate and available during study period were included in the study.

2. Exclusion Criteria

Nurses who are in annual leave and seriously ill during data collection period in the previous settings were excluded from the study.

Data Processing and analysis

Data were collected, tabulated, statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 20 where the following statistics were applied.

Results

Table 1 and figure 1 showed demographic characteristics of studied group revealed that 71.1% of nurses were in the age group (20 - < 25). Thirty two percent of them had Bachelor degree. The study showed that none of nurses had any previous training in sepsis or systemic inflammatory response syndrome.

Table 2: illustrated that only 33.3% of nurses were able to indicate whether child has sepsis or not. While 64.4% were able to recognize septic shock but were unable to identify the earlier stages of the sepsis continuum. The questions that followed asked participants to select all of the signs/symptoms that indicate a child is experiencing SIRS or sepsis and 81.1% recognized it.

/known infection (73.3%).While 38.9% of nurses able to identify the following indicators WBCs count less than 4 X 10³/mm³.

Table 3: List of indicators to nurses to select all indicates SIRS or sepsis. It sorted by correctly identified indicators.

S. No	Indicator	Correct Answer	Percentage
1	Temperature great than 38.5 degrees Celsius	Yes	88.9
2	Suspected/Known Infection	Yes	73.3
3	Heart rate greater than 140 B/M in a child	Yes	51.1
4	White blood cell count greater than 12 X 10 ³ /mm ³	Yes	71.1
5	Heart rate greater than 180 BPM in an infant	Yes	74.4
6	Respiratory rate greater than 30 in a child	Yes	71.1
7	Respiratory rate greater than 50 in an infant	Yes	71.1
8	Immature neutrophils ("bands") greater than 10%	Yes	66.7
9	Temperature less than 36 degrees Celsius	Yes	44.4
10	Heart rate less than 60 BPM in an infant	Yes	47.8
11	Mechanical ventilation for an acute process	Yes	72.2
12	White blood cell count less than 4 X 10 ³ /mm ³	Yes	38.9
13	Heart rate less than 60 BPM in a child	No	68.9
14	Respiratory rate less than 20 in an infant	No	53.3
15	Respiratory rate less than 10 in a child	No	56.7

Table 4: showed that there are knowledge deficits regarding priority of nursing intervention (27.2%, 18.9% & 8.9%) related to normal saline, nasal cannula or reassure mother. Also, there was knowledge deficit related to importance of assessment method as Sodium, potassium & WBCs (5.6%) and 25.6% of nurses select capillary refill and platelet count. As well as there was knowledge deficit regarding Lactate level 12.2%.

Table 4: Case Studies

Case Study 1: B.R., a two-year-old female, has just been admitted to the floor after a 1 week history of upper respiratory tract infection symptoms (rhinorrhea and cough with intermittent nasal flaring). She has had cultures drawn and is on broad-spectrum intravenous (IV) antibiotics as well as maintenance IV fluids. The mother says, "She just isn't acting right." Temp - 38.6 degrees Celsius. HR - 182. RR - 31. BP - 78/50. O2 sat - 98% on room air. Cap refill 4 seconds. Of the following options, what would your priority intervention be?			
No	Options	Correct Answer	Percentage
A	Give the available PRN Tylenol and monitor temperature.	No	44.4
B	Notify MD/NP and anticipate an order for normal saline (NS) fluid bolus.	Yes	27.8
C	Apply bi-nasal cannula (BNC) at 1 to 2	No	18.9

	L/minute.		
D	No intervention required. Reassure mother the patient is fine.	No	8.90
Case Study 2, Question 1. You have a "gut feeling" that he's not doing well. You tell the physician your concerns, and she doesn't feel anything appears important enough to require an intervention. Which of the following responses would be the most important findings in justifying the need for an intervention (or at least a much higher degree of assessment)?			
No	Options	Correct Answer	Percentage
A	Capillary refill and platelet count.	No	25.6
B	Glucose level, temperature, and respiratory rate.	No	45.6
C	Sodium level, potassium level, and white blood cell count.	No	5.6
D	White blood cell count and respiratory rate.	Yes	23.3

Case Study 2: Question 1 Rationale: WBC and respiratory rate are the only listed options that are abnormal findings, and their presence indicates SIRS. All other values are within normal limits.

Case Study 2, Question 2. After describing the patient situation, background, and assessment to the physician, what would you recommend she order to further investigate the problem or treat it? (Select all that apply.)			
No	Options	Correct Answer	Percentage
A	Draw blood cultures.	Yes	55.6
B	Apply oxygen.	No	14.4
C	Administer 20 mL/kg of NS intravenously.	No	17.8
D	Draw a lactate level.	Yes	12.2
A/D	Selected BOTH of the correct options		

(Continued) Case Studies

Case Study 2, Question 2 Rationale: Because the patient has two of four SIRS criteria along with a suspected infection (open fracture with increasing redness), sepsis is present. No other abnormalities exist that indicate the patient is progressing to severe sepsis or septic shock. Therefore, aggressive treatment is not needed at this time. Drawing blood cultures and a lactate level will allow the clinicians to prescribe appropriate antibiotics and determine if the tissues are being adequately perfused, respectively. Oxygen and intravenous fluids are not needed at this time because heart rate, blood pressure, and oxygen saturation are within normal limits.			
Prioritization Scenario. Which of the following patients would you be most likely to notify the physician of first because the patient may be septic?			
No	Options	Correct Answer	Percentage
A	Four-year-old rule out	No	23.3

	meningitis. Temp - 37.4. HR - 165. RR - 22. BP - 90/55. O2 sat - 99% on room air. WBC - 10.0. WBC Bands - 7.		
B	Two-month-old with pneumonia. Temp - 36.2. HR - 158. RR - 32. BP - 78/50. O2 sat - 97% on bi-nasal cannula (BNC) at 1 L/min. WBC - 14.5. WBC Bands - 18.	No	26.5
C	Eight-year-old post-op appendectomy. Temp - 35.8. HR - 130. RR - 24. BP - 86/45. O2 sat - 97% on room air. WBC - 3.2. WBC Bands - 11.	Yes	50.2
<p>Prioritization Scenario Rationale: Patient C is the highest priority patient because the WBC is depressed indicating potential bone marrow failure, a later sign of a severely decompensating patient. This is in addition to the hypothermia and tachycardia (totaling 3 of 4 SIRS criteria) with suspected infection (post-operative patient). Patients A and B are not experiencing SIRS (only have 1 of 4 SIRS criteria).</p>			

	experiencing SIRS/sepsis (or even septic shock), I feel this is a high-priority patient necessitating immediate action by a physician/nurse practitioner.			
6	If I have a patient who I feel is experiencing SIRS/sepsis or septic shock, I feel comfortable calling or initiating the chain-of command if the patient's physician/nurse practitioner isn't ordering appropriate and safe interventions (including additional labs/tests, fluid boluses, medications, etc.).	18.9	35.6	45.6
7	I know what to do with a patient in septic shock until the additional support (MDs, RNs, RTs) arrives.	17.8	44.4	37.8

Table 5: demonstrated that 68.9% of nurses feel comfortable recognizing when patient experiencing septic shock. On other hand 65.6% of nurses feel comfortable notifying a physician/nurse practitioner that one of my patients is experiencing SIRS/sepsis based solely on my assessment of the patient. Approximately two thirds of nurses (60%) feel comfortable recognizing when a patient is experiencing SIRS and sepsis.

Table 5: showed 3-item Likert scales to determine nurses' attitudes towards the importance of SIRS recognition

No		Strongly/Somewhat Disagree (%)	Neutral (%)	Strongly/Somewhat Statement (%)
1	I feel comfortable recognizing when a patient is experiencing SIRS.	8.9	31.1	60
2	I feel comfortable recognizing when a patient is experiencing sepsis.	10	46.7	43.3
3	I feel comfortable recognizing when a patient is experiencing septic shock.	11.1	20	68.9
4	I feel comfortable notifying a physician/nurse practitioner that one of my patients is experiencing SIRS/sepsis based solely on my assessment of the patient.	8.9	25.6	65.6
5	If I have a patient who I feel is	3.3	35.6	61.1

Figure (1): Nurses 'Years of Experience. The figure showed that the majority of them had 1-<5 years of experience

Figure (2): Distribution of nurses according to their educational level. The figure illustrated that minority of them are master degree and technical nursing institute (2.2% & 5.5%) respectively.

Figure(3): represented nurses' previous training in sepsis. The figure showed that none of nurses had any previous training in sepsis

Figure 1: showed Nurses 'Years of Experience

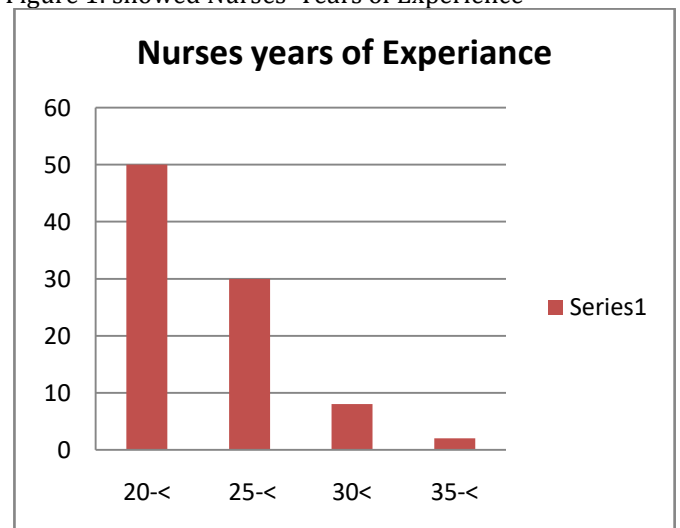


Figure 2: Distribution of nurses according to their educational level

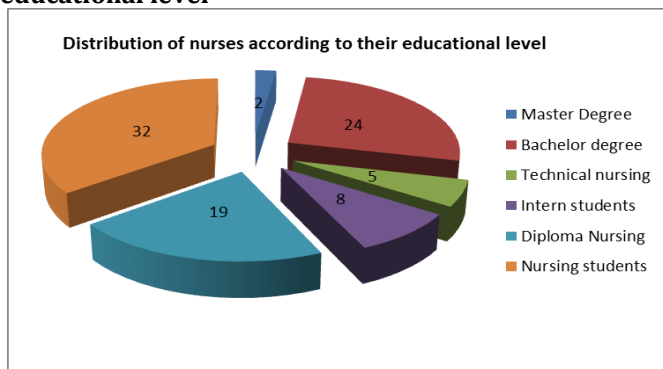


Figure 3: represented nurses' previous training in sepsis



Discussion

Regarding demographic characteristics of studied nurses, the present study revealed that the majority of nurses in Neonatal intensive care unit at Menoufia University Hospital 75.6% and 24, 4 % of nurses at El Bagour Central Hospital. Nurse’s age ranged between 20 to 36 years old. In addition 71.1% of nurses were in the age group (20 - < 25). This could show that the majority of nurses are newly educated and they need to acquire more knowledge and skills. This finding came on the same line with (23) who mentioned that may be due to the unit nature, they prefer the newly graduate to work in NICU as they had the ability to acquire knowledge and change their behaviors based on submission of up to date knowledge. In this regard (24) mentioned in their study that there is a need for an orientation program for all nurses about sepsis in NICU, select the nurses with high level of education to work in such area and encourage the expert nurse to teach new nurses and still keep on. The finding was incongruent with another study (25) who revealed that the nurses' factors related to in-service training had no effect on both nurses' knowledge and performance.

The study showed that none of nurses had any previous training related to sepsis or SIRS that may lead to unsafe care. This could be due to lack of motivation for training and work overload. So, enhancing nurse's level of education and continuous training through in-service education was promptly needed. This finding came on the same line with (26) who mentioned that continuous educational programs are necessary for empowerment of nurses to maintain their current skills and theoretical knowledge. In this regards (9) who mentioned that updating knowledge and performance of ICU nurses through continuing in-service educational programs is emphasizing the importance of the latest evidence-based practices regarding sepsis in continuing education / training programs and correction of poor practices are

required as well as providing training programs for newly joined ICU nurses about sepsis at regular intervals.

Concerning the first set of scenarios the study was demonstrated that only 33.3% of nurses were able to experience child sepsis. This finding is in agreement with what of (27) who reported that there were significant knowledge deficit among nurses in several key areas of SIRS/sepsis recognition, especially in recognizing patients in earlier stages of the sepsis continuum. This was in agreement with (28) who revealed that critical care nurses had unsatisfactory knowledge and performance level regarding sepsis. These results was in line with (27) who reported that approximately two-thirds (68%) of the studied nurses had unsatisfactory knowledge level. In this regards (29) mentioned in his study that there are poor knowledge of sepsis in identifying the characteristics of SIRS criteria and patients at high risk for sepsis, which are key components of early sepsis recognition (14.9%). Therefore, this illustrates the importance of in-service educational program for nurses to improve their knowledge.

This study demonstrated that 64.4% of nurses were able to recognize septic shock and 81.1% of nurses reported if there was no indicator of suspected / known infection. The results were inconsistent with (30) showed that knowledge of systemic inflammation and sepsis is only at a satisfactory level among nurses. This could be related to acquire some knowledge from physicians and patients. In relation to nurses information to select the objective data used in determining patient is experiencing SIRS or not. The study showed that the majority of nurses can identify systemic inflammation by temperature changes 88.9% , increased or reduced WBCs count 74.4%, Suspected/Known infection 73.3% . In this regards (31) reported that Heart rate, temperature, and WBC count (chosen by 97%, 96%, and 91% of participants, respectively) were correctly identified and chosen by most participants. This may related to experience in dealing with patient with sepsis.

The majority of nurses unable to identify the following indicators such as White blood cell count less than $4 \times 10^3/\text{mm}^3$ (38.9%). This was on the same line with (32) who demonstrated nurses were unable to identify the earlier stages of the sepsis continuum. As well as 51.1 % of nurses were aware about heart rate greater than 140 B/M in a child and 53.3% of nurses identified respiratory rate less than 20 in an infant. This was consistent with (33) who mentioned that only half of the sample was aware of the importance of tachycardia, tachypnea 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. This could reflect that in order to achieve the maximum level of knowledge, continuous training programs are required.

In relation to assessment of nurses, it illustrated that there were knowledge deficit regarding Sodium level, Potassium level, and White blood cell count (5.6%). The most commonly unrecognized investigation and treatment of lactate level was 12.2%, followed by Oxygen Saturation 14.4%. This finding is in agreement with (27) who reported significant knowledge deficit was evident regarding the role of serum Lactic acid levels in diagnosing sepsis. This goes in the same line with (31) who found that there was a significant knowledge deficit among nurses regarding serum lactic acid levels in diagnosing sepsis. This

finding is in agreement with (34) who revealed that overall nurses' knowledge levels are poor and poor knowledge affect patient care by increasing the length of stay in hospital, use of resources (time, staff, money, and space) and mortality rates. Therefore, it is highly recommended that an educational intervention be implemented for acute and critical care pediatric nurses to aid them in recognizing sepsis in its earliest stages.

Finally, nurses were asked to use a Likert scale to rate several statements regarding recognition and nursing management of the patient with SIRS/sepsis. This resulted showed that 68.9% of nurses feel comfortable recognizing when a patient is experiencing septic shock. As well as 65.6% of nurses feel comfortable notifying a physician/nurse practitioner that one of my patients is experiencing SIRS/sepsis based solely on my assessment of the patient. This was consistent with (35) who reported that 35% of nurses did not feel competent recognizing the early signs and symptoms of sepsis. Severe sepsis was incorrectly identified 8.7-61% of the time. This finding was similar in (36) who reported that 242 pediatric nurses had difficulty differentiating between SIRS and sepsis. Therefore, increasing nurses' knowledge and awareness of sepsis will improve recognition and management of patients.

CONCLUSION

The results of the present study concluded that there were knowledge deficit among nurses in several key areas of SIRS/sepsis recognition, knowledge of systemic inflammatory response syndrome and sepsis. Therefore, increasing nurses' knowledge and awareness of sepsis will help to improve recognition and prompt aggressive management and ensuring that patients are given the best care.

Recommendations

1. Educational interventions should be implemented to all nurses to improve their knowledge about sepsis to aid them in recognizing sepsis in its earlier stages.
2. Updating knowledge and performance of ICU nurses and newly joined ICU nurses about sepsis
3. Continuing in-service educational programs and emphasizing evidence-based practices regarding sepsis care
4. Continuous observation of nurses' performance and utilization of sepsis bundle and correction of poor practices are required
5. Simple documents to provide information for nurses about the unit and treatments
6. Seminars should be focused on the issues that need improvement for nurses' awareness of sepsis
7. Posters with information related to sepsis recognition and treatment could be displayed in nurses' work environment.

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