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Implementing Nursing Management Protocol Regarding Early Recognition of Maternal Sepsis

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Abstract: *The **aim** of the study was to evaluate the effect of implementing a nursing management protocol regarding early recognition of maternal sepsis.*
Design*: A quasi-experimental design was used.*
Setting*: The study was conducted at the Obstetric and Gynecology Department and Intensive Care Unit in Helwan General Hospital.*
Sample: *A convenient sample of 52 nurses working at the previously mentioned settings were recruited for the study. Two **tools** were used for data collection; I) A structured interviewing questionnaire, included socio demographic characteristics of the study nurses and assessment of nurses' knowledge regarding maternal sepsis. II) Observational checklist for evaluating nursing management of maternal sepsis.*
Results *showed that the majority of nurses had unsatisfactory knowledge before implementation of the protocol. However, slightly more than three quarters of them had satisfactory knowledge after implementation. As well, more than three quarters of them had inadequate practices toward maternal sepsis care before implementation of the protocol. Meanwhile, after implementation the majority of them had adequate practices. There was a highly statistically significant difference before/after implementing nursing management protocol regarding early recognition of maternal sepsis ($P \leq 0.001$).*
Conclusion: *Nurses' management protocol has a positive effect on nurses' knowledge and practices regarding maternal sepsis.*
Recommendation: *Continuous refreshment courses and follows up programs for nurses regarding maternal sepsis care are required.*

Keywords: *Maternal sepsis care, nursing management protocol*

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I. Introduction

Sepsis which is a major public health concern includes three essential components: infection, host response to infection and organ dysfunction (1). Maternal Sepsis is a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion, or post-partum period (2)

Worldwide incidence of death during pregnancy, labor, or shortly thereafter is approximately 300,000 annually. The World Health Organization estimates that sepsis causes 10.7% of these maternal deaths. Although sepsis often worsens rapidly, necessitating intensive care, antibiotics alone are effective in the early stages ***(3).***

puerperal sepsis is the infection of the genital tract occurring at any time between the rupture of membranes or the onset of labor, and the 42nd day postpartum, in which a fever (oral temperature 38.5°C or higher on any occasion) and one or more of the following signs and symptoms are present: pelvic pain, abnormal vaginal discharge and sub involution ***(4)***

Pregnant women with sepsis can deteriorate and die rapidly after the onset of symptoms. Prompt recognition, stabilization and treatment of the underlying cause can avoid the rapidly spiraling deterioration that leads to cell death and, ultimately patient death. The recognition of shock is clinical and depends on identification of the cluster of subtle signs that indicate developing tissue hypoxia and organ dysfunction. Tachypnea and tachycardia are often early signs, followed by hypotension and poor urine output, pale, clammy skin, cool peripheries and altered level of consciousness. The altered physiology of a pregnant woman may obscure the early signs of developing shock, making recognition and early treatment even more difficult (***5).***

Pregnant women are particularly predisposed to develop infections and sepsis for several reasons. Physiological, immunological and mechanical changes in pregnancy make pregnant women more susceptible to infections compared with non-pregnant women, particularly during the postpartum period (***6)***. However, a

researcher stated that there are several well-established risk factors for maternal sepsis including; Caesarean Section (CS) delivery, prolonged rupture of the membranes, preterm labor, multiple vaginal exams, obesity, diabetes, anemia and invasive diagnostic and therapeutic interventions have increased, with their recognized risk of infection(***7***).

Maternal sepsis is often undiagnosed or misdiagnosed because infection begins after hospital discharge without proper follow-up of cases ***(8).*** Early diagnosis and timed intervention with early goal directed therapy improves outcome of severe sepsis and septic shock, decreases hospital stay length and hospital cost. This requires multidisciplinary approach; includes physicians, nursing, clinical pharmacist, intensivist and hospital administration ***(9).***

Blood cultures and other samples as guided by clinical suspicion of the focus of infection (e.g. throat swabs, mid-stream urine, high vaginal swab, or cerebrospinal fluid) should be obtained prior to starting antibiotic therapy as they may become uninformative within a few hours of commencing antibiotics but must not delay antibiotic therapy. Serum lactate should be measured within six hours of the suspicion of severe sepsis in order to guide management. Serum lactate ≥4 mmol/l is indicative of tissue hypo perfusion **(*10*).**

Bacteria called group A Streptococcus (GAS) are an important cause of maternal sepsis. GAS usually cause mild throat infections and skin infections, or may have no symptoms at all. However, sometimes the bacteria are able to evade the body's normal defense mechanisms and cause sepsis. Infection may be localized to the uterus or it can spread to involve fallopian tubes and ovaries or into the blood stream ***(11).***

Finding of a recent research carried out in 2017, stated that, maternal sepsis must be treated as emergency and healthcare providers should be familiar with prevention strategies and the importance of early recognition and treatment. ***(7)*** Meanwhile, another recent study clarified that sepsis usually is treated with intravenous fluids and antibiotics. Typically, antibiotics are given as soon as possible. Often, ongoing care is performed in an intensive care unit. Mechanical ventilation and dialysis may be needed to support the function of the lungs and kidneys, respectively. To guide treatment, a central venous catheter and an arterial catheter may be placed for access to the blood stream ***(12).***

The following priority interventions are recommended: Treat PPROM, maintain asepsis during birth, perform rigorous hand washing during birth, make minimal use of invasive procedures, teach all pregnant and recently postpartum women signs and symptoms of genital tract infections, be vigilant for endometritis during the postpartum period, ensure an early home visit or postnatal care facility for woman and baby (***13,14,15).***

Access to the intensive care unit is not the only measure of the quality of obstetric care delivered but it is an important aspect of care. An early referral to the intensive care unit and, therefore, optimal care of circulation, blood pressure and ventilation may reduce the occurrence of multiorgan failure in at-risk patients. A close monitoring of high-risk pregnant women and an optimum stabilization of their situation before intervention improves the outcome for these women ***(16).***

Nurses must keep in mind that the risks of sepsis and the high mortality rate are associated with sepsis, severe sepsis, and septic shock. Early recognition and treatment of maternal sepsis will improve survival, decrease length of stay in the hospital. Delay in diagnosis and treatment of maternal sepsis has been shown to increase mortality so that we need protocols for early recognition (***17).***

Significance of the study:

Sepsis is one of the top four causes of maternal mortality. Pregnant women are more vulnerable to infection and susceptible to serious complications. Screening protocols are needed for early recognition and management of maternal sepsis. All perinatal staff must be trained on early recognition and management of maternal sepsis.***(18).*** Education of nurses about early signs and symptoms of sepsis in pregnancy and use of obstetric-specific tools can assist in timely identification and better outcomes ***(19).***

Maternal sepsis has a significant impact on neonatal mortality, via vertical transmission of infection, with over one million infection-related neonatal deaths every year (***20)***. Intra-amniotic infections cause neonatal sepsis, pneumonia and respiratory distress. They are also linked to long-term neurologic impairment in infants (***21).***

Globally, there were 289 000 maternal deaths in 2013 with more than 1 life lost every 2 minutes. In Egypt, about 860 Egyptian women died from complications related to pregnancy and childbirth in 2013 with a maternal mortality ratio of 45 maternal deaths per 100 000 live births and a lifetime risk of maternal death of 1 in 710 (22***).***

While in a previous similar study, findings stated that; over 5 million/year of maternal sepsis occur globally with an estimated 75,000 maternal deaths, and also mentioned that risk of maternal mortality; in high-income countries is 2.1% of all maternal deaths and in low-income countries, 11.6% of maternal deaths. e.g, 2–2.7-fold higher in Africa, Asia, Latin America and the Caribbean than in developed countries (**23**).. Sepsis is still an important contributor to preventable maternal mortality. Infections are considered the underlying cause in about 11% of maternal deaths ***(24)***

Septic shock arising in pregnancy or after delivery may be difficult to diagnose and women may deteriorate rapidly. Early warning scoring systems may aid prompt diagnosis so treatment can begin rapidly and a crisis may be averted. If shock develops, it will affect multiple organ systems and may do so rapidly and catastrophically. Management must be multi-disciplinary including early liaison with the critical care team. (***5)***

Aim of the Study

This study aimed to evaluate the effect of implementing a nursing management protocol regarding early recognition of maternal sepsis. This aim was achieved through:

1. Assessing nurses' knowledge and practices regarding early recognition of maternal sepsis
2. Designing and implementing a nursing management protocol regarding early recognition of maternal sepsis.
3. Evaluating the nursing management protocol after application regarding early recognition of maternal sepsis.

Research Hypothesis

Nurses' management protocol will have a positive effect on nurses' knowledge and practices regarding early recognition of maternal sepsis.

II. Subjects and Methods

Research Design

A quasi-experimental design was used for conducting the study.

Setting

The study was conducted at the Obstetrics and Gynecology Department and Intensive Care Unit in Helwan General Hospital.

Sample Type: A convenient sample.

Sample Size: A total of 52 nurses working in the previously mentioned settings at the time of data collection were recruited for the study.

Technique: The researchers visited the setting three days per week and met with nurses according to working circumstances, nurses' physical and mental readiness to recruit the sample.

Tools of Data Collection

Two tools were utilized for data collection. They were designed by the researchers.

***First Tool: A* structured interviewing questionnaire**:

This tool designed by the researchers, after reviewing related literature, includes two parts

***Part 1*:** Sociodemographic characteristics of the study nurses as age, educational level, years of experience, and previous training course about maternal sepsis care.

***Part 2*:** Assessment of nurses' knowledge regarding maternal sepsis as definition, causative organism, spread of infection, clinical features of maternal sepsis, perinatal screening criteria, common causes, risk factors, prevention, newborn complications from maternal sepsis and priorities of nursing care for maternal sepsis.

Scoring system:

The questions were scored as the following; score (2) was given for the correct complete answer, (1) for the correct incomplete answer (0) for the incorrect answer before and after application of the protocol. The scores of total knowledge were considered as satisfactory if more than 60 %, and unsatisfactory if equal or less than 60%. The total score ranged from 0 – 20.

Second Tool:

An observational checklist: Adapted from the bacterial sepsis in pregnancy: Green –top guideline of the Royal College of obstetricians and Gynecologists, to evaluate nursing practices regarding maternal sepsis which include basic nursing care in maternal sepsis such as resuscitation (basic nursing care airway, oxygen administration, breathing monitor temperature and circulation); nursing management of vaginal bleeding, puerperal sepsis, septic shock, mastitis; Infection control measures, and assessment of tender, sub-involute

uterus, chills and general malaise, woman; demonstrate proper fundal massage, assessment of fetal and newborn wellbeing, a urinary catheter care, perineal care, and arrange for transfer to intensive care setting as appropriate **(25).**

Scoring system:

The checklist items were scored (2) for each step done correctly while (1) score was given for not done. The scores of total practices were considered adequate if › 80% and inadequate if ≤ 80%. The total score ranged from 1 – 26.

Tools Validity and Reliability

The tools were reviewed for comprehensiveness, appropriateness of items and measuring the concepts through a jury panel of five experts in the field of maternity nursing, obstetric medicine and adult health nursing specialties to assure content validity. The reliability was done by Cronbach's Alpha coefficient test which revealed that two tools consisted of relatively homogenous items as indicated by the moderate to high reliability of each tool. The internal consistency of nurses' knowledge was α 0.87, and nursing practices was α 0.92.

Ethical considerations:

All ethical issues were assured, participants were given explanations about the aim of the study, and then an oral consent was obtained from each. Withdrawal from the study at any stage before the completion of the study was allowed. Confidentiality of participants' information was assured and the data were accessed only by the researchers involved in the study.

The pilot study

The pilot study was carried out on 10% of the total sample (5 nurses) to ascertain the relevance, clarity, applicability of the tools and to detect any problems peculiar to the statements. Also, the pilot study helped to estimate the time needed to complete the questionnaires. According to the results of the pilot study, no modifications were done. Nurses involved the pilot study were included in the main study sample.

Field of study:

The study was carried out from the beginning of August, 2017 and completed at the end of January, 2018, covered six months. An official approval was obtained through a letter issued from the Dean of Faculty of Nursing to the Director of Helwan General Hospital. The researchers visited the previously mentioned settings three days per week from 9.00 a.m until 1.00 p.m. The study was carried out through four phases: assessment, planning, implementation, and evaluation.

1. Assessment phase:

Nurses were assessed for their needs prior to implementation of the nursing management protocol sessions included the researcher s collected the following data: Demographic data, of the nurses, nurses' knowledge about maternal sepsis care, nurses' practices regarding maternal sepsis care. The data obtained during this phase constituted the baseline for further comparisons to evaluate the effect the nursing management protocol regarding maternal sepsis care. Average time for the completion of the tools for each nurse was around 20-30 minutes.

2. Planning phase:

The content of the nursing management protocol related to maternal sepsis was designed to meet the following objectives:

a) General objective:

At the end of nursing management protocol sessions each nurse should be able to acquire essential knowledge and practices needed to provide competent care to women with maternal sepsis.

b) Specific objectives

At the end of protocol's sessions, each nurse should be able to: Define maternal sepsis, list and discuss causes of maternal sepsis, give priorities of nursing care for maternal sepsis, apply preparations needed for maternal sepsis care, discuss causes of vaginal bleeding in maternal sepsis, determine priorities of nursing care for bleeding in maternal sepsis, apply the nursing care for septic shock, explain causes, signs and symptoms of infection in maternal sepsis. As well as the nurses should be able to practice proficiently all procedures related to maternal sepsis situations.

3. Implementation phase:

The nursing management protocol was carried out at the obstetrical and gynecological department and intensive care unit in Helwan General Hospital. Based on the results obtained from assessment phase using the interviewing questionnaire and observation checklist, teaching and training were constructed to satisfy the studied nurses' deficit knowledge and practices about maternal sepsis care. Implementation of teaching and training took 14 weeks' period and were implemented for a group of (4-5) nurses according to working circumstances, nurses' physical and mental readiness. The researchers visited the settings three days per week. The overall sessions were 8 sessions (3 theoretical and 5 practical), nurses were divided into 10 groups and the content was implemented for each group separately. The duration of each theory session ranged from 20-30 minutes, while the practical session ranged from 30-60 minutes including periods of discussion according to their achievement, progress and feedback. At the beginning of first session an orientation to the program, general and specific objectives were explained. Arabic language was used to suit all levels of education. The teaching methods and training strategies were used such as modified lecture, group discussion, demonstration and re-demonstration for clinical procedures, Instructional media included colored posters, power point presentation and handouts prepared by the researchers and distributed to all nurses in the first day of the training. At the end of each session, nurses' questions were discussed to correct any misunderstanding and feedback was done. Most nurses were cooperating and interested by the topic.

3) Evaluation phase:

After completion of the protocol sessions the questionnaire formats and observational checklist were filled in again to evaluate the effectiveness of the protocol with the same pretest questionnaire.

Statistical Design:-

Data entry and analysis were done using the Statistical Package for Social Sciences (SPSS),version 20.0 followed by tabulation. Descriptive statistics were applied (mean, standard deviation, frequency and percentages). Test of significance as Chi-square was used to test the study hypothesis. A statistically significant difference was considered at $p \leq 0.05$, and a highly statistically significant difference was considered at $p \leq 0.001$.

III. Results

Results:

Table (1): Distribution of the Studied Nurses According to their Socio demographic Characteristics (n=52).

Characteristics	N=52	
	Number	Percent
Age in years:		
< 20	13	25
20- <30	31	59.6
30+	8	15.4
Mean ± SD	25.48± 4.20	
Educational level:		
Secondary school	20	38.5
Technical Institute	26	50.0
Bachelor degree	6	11.5
Years ofExperience		
< 1	7	13.5
1-5	30	57.7
>5	15	28.8
Mean ± SD	4.82± 3.67	
Training course about maternal sepsis care		
Yes	6	11.5
No	46	88.5

Table (1) shows that, 59.6% of studied nurses their age ranged between 20- <30years, with a mean of age 25.48 ±4.20. Regarding educational level, half of them 50.0% had technical institute and only 11.5% had bachelor degree. As regards years of experience, more than half of them 57.7% had 1-5 years of experience, while 28.8 had more than 5 years of experience, with a mean year of experience 4.82 ± 3.67. The majority of the studied nurses 88.5% did not receive any training course regarding maternal sepsis in the department.

Table (2): Distribution of the Studied Nurses Regarding their Knowledge about Maternal Sepsis Before / After Management Protocol (n=52).

Variables	Before (n=52)						After (n=52)						X^2	P-value
	Correct		Correct incomplete		Incorrect		Correct		Correct incomplete		Incorrect			
	NO	%	NO	%	NO	%	NO	%	NO	%	NO	%		
Definition of maternal sepsis	0	0.0	18	34.6	34	65.3	38	73.1	12	23.1	2	3.8	67.64[a]	<0.000**
Causative organism of maternal sepsis.	2	3.8	10	19.3	40	76.9	36	69.2	13	25.0	3	5.8	62.65[a]	<0.000**
Spread of infection in maternal sepsis	4	7.7	6	11.5	42	80.8	36	69.2	14	27.0	2	3.8	65.16[a]	<0.000**
clinical features of maternal sepsis	0	0.0	14	26.9	38	73.1	34	65.4	18	34.6	0	0.0	72.50[a]	<0.000**
Prenatal screening criteria	3	5.8	17	32.7	32	61.5	37	71.2	14	26.9	1	1.9	58.31[a]	<0.000**
Common causes of maternal sepsis	2	3.8	18	34.6	32	61.5	35	67.3	14	26.9	3	5.8	65.16[a]	<0.000**
Risk factors for maternal sepsis	2	3.8	20	38.5	30	57.7	32	61.5	18	34.6	2	3.8	51.07[a]	<0.000**
Prevention of maternal sepsis	4	7.7	18	34.6	30	57.7	35	67.3	15	28.9	2	3.8	49.41[a]	<0.000**
Newborn complications from maternal sepsis	0	0.0	18	34.6	34	65.4	36	69.2	14	26.9	2	3.8	64. 94[a]	<0.000**
Priorities of nursing care for maternal sepsis	2	3.8	13	25.0	37	71.2	39	75.0	10	19.2	3	5.8	62. 68[a]	<0.000**

** Highly statistically significant difference ($P \leq 0.000$)

Table (2) reveals that, there were highly statistically significant differences before and after protocol regarding the studied nurses' knowledge with p= <0.000

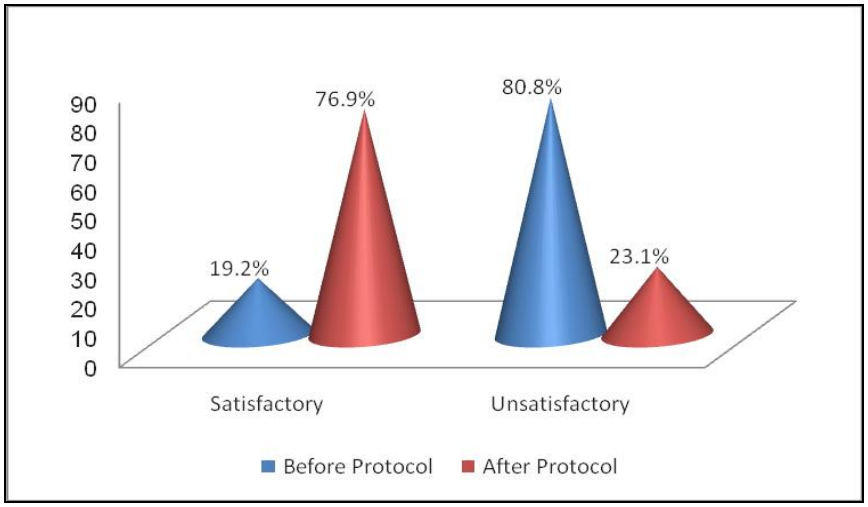

Figure (1) Percentage Distribution of the Studied Nurses in Relation to their total Knowledge Score Before/ After Protocol.

Figure (1) clarifies that 80.8% of studied nurses have unsatisfactory knowledge before protocol compared to 76.9% after protocol have satisfactory knowledge.

Table 3: Distribution of the Studied Nurses Regarding Practices about Maternal Sepsis Before / After Management Protocol (n=52).

Variables	Before n=52				After n=52				X^2	P-value
	Done		Not Done		Done		Not Done			
	No	%	No	%	No	%	No	%		
Basic nursing care (ABCs of resuscitation: airway, oxygen admin, breathing, circulation and temperature).	16	30.8	36	69.2	46	88.5	6	11.5	35.94[a]	<0.000**
Management of vaginal bleeding	14	26.9	38	73.1	44	84.6	8	15.4	35.08[a]	<0.000**
Infection control measures.	13	25.0	39	75.0	35	67.3	17	32.7	18.72[a]	<0.000**
Management of puerperal sepsis.	16	30.8	36	69.2	46	88.5	6	11.5	35.94[a]	<0.000**
Management of septic shock.	12	23.1	40	76.9	42	80.8	10	19.2	34.66[a]	<0.000**
Management of mastitis.	15	28.8	37	71.2	41	78.8	11	21.2	26.15[a]	<0.000**
Assessment tender, sub-involuted uterus.	18	34.6	34	65.4	45	86.5	7	13.5	29.35[a]	<0.000**
Assessment chills and general malaise.	7	13.5	45	86.5	47	90.7	5	9.6	61.63[a]	<0.000**
Demonstrate proper fundal massage.	19	36.5	33	63.5	44	84.6	8	15.4	25.16[a]	<0.000**
Assessment of woman, fetal and newborn well-being.	11	21.2	41	78.8	45	86.5	7	13.5	44.72[a]	<0.000**
Urinary catheter care	8	15.4	44	84.6	47	90.4	5	9.6	58.69[a]	<0.000**
Perineal care	8	15.4	44	84.6	47	90.4	5	9.6	58.69[a]	<0.000**
Arrange for transfer to intensive care setting as appropriately	7	13.5	45	86.5	47	90.7	5	9.6	61.63[a]	<0.000**

** Highly statistically significant difference ($P \leq 0.000$)

Table (3) clarifies that; there were highly statistically significant difference between studied nurses level of practice at all items with P=<0.000.

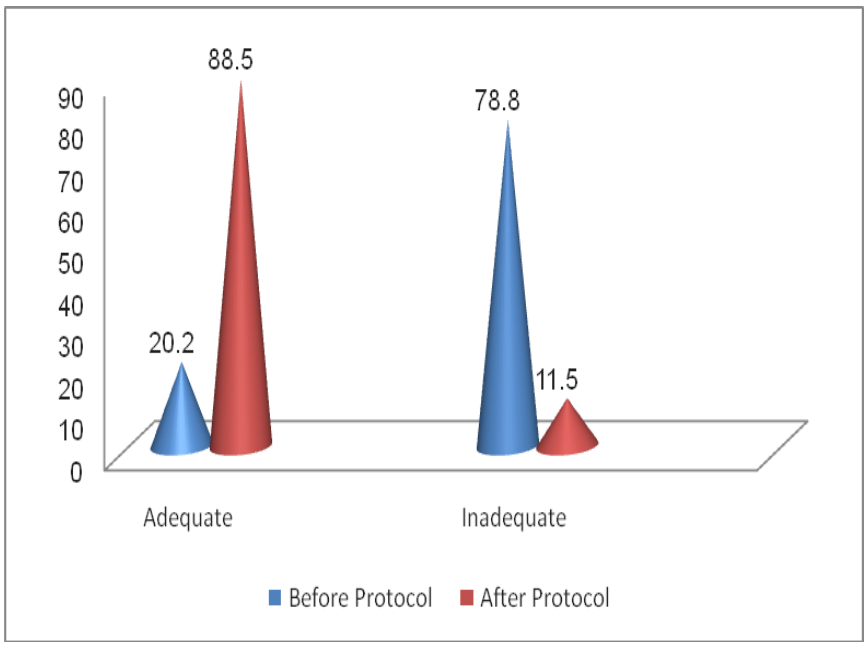

Figure (2) Percentage Distribution of the Studied Nurses Regarding Total Nursing Practices Before/ After Management Protocol.

Figure (2) Illustrates that 78.8% of studied nurses have inadequate practices before protocol compared to 88.5% after protocol have adequate practices respectively.

Table (4): Correlation Coefficient Between Total Nurses Knowledge Scores Regarding Nursing Care of Maternal Sepsis Before /After Management Protocol, Age and Years of Experience.

Variables	Total knowledge before		Total knowledge after	
	r	p	r	P
Age	0.162	< 0.01	0.329	< 0.01
Years of Experience	0.173	< 0.01	0.443	< 0.01

Table (4): indicates that, there were highly positive statistically significant correlations between knowledge and age before and after management protocol. Also, there were highly positive statistically significant correlations between knowledge and years of experience before and after management protocol P=< 0.01.

Table (5): Correlation Coefficient Between Total Nurses' Practices Scores Regarding Nursing Care of Maternal Sepsis Before/After management protocol, as regards age and years of experience.

Variable	Total practices before		Total practices after	
	r	p	r	P
Age	0.256	< 0.01	0.590	< 0.01
Years of Experience	0.254	< 0.01	0.288	< 0.01

Table (5) displays that; there were highly positive statistically significant correlations between practices and age before and after management protocol. Moreover, there were positive statistically significant correlations between practices and years of experience before and after management protocol P=< 0.01.

Table (6): Correlation Coefficient Between Total Scores of Nurses' Knowledge and Practices Before/after Management protocol.

Variable	Total Knowledge before		Total Knowledge after	
	r	p	r	P
Practices before training Practices After training	0.699	>0.05	0.722	< 0.01

Table (6) reveals that, there were highly positive statistically significant correlations between knowledge and practice before and after management protocol P=< 0.01.

IV. Discussion

Sepsis is a common cause of mortality and morbidity worldwide. It is the leading cause of death in the ICU in the United States. Although maternal sepsis is a small fraction of total sepsis cases and an infrequent complication of pregnancy, childbirth and puerperium (***26)***. Nurses caring for woman during the child birth process may encounter cases of obstetric sepsis and should be aware of the latest evidence and clinical guidelines to support practices that promote optimal outcomes for mothers and babies ***(27)***.This study was aimed to evaluate the effect of implementing a nursing management protocol regarding early recognition of maternal sepsis.

Regarding sociodemographic characteristics the results of the present study revealed that nearly three fifth of the studied sample their age ranged between 20- <30 years with a mean age of 25.48±4.20. This may be attributed that this age group is the common age of nurses who give care for maternity women. Regarding educational level, the highest percentage of nurses representing half of them had technical institute of nursing. These results are close to those of another study done in Egypt, Which studied the Effect of a Developed Educational Booklet about Standard Infection Control Precautions on Nurses' Knowledge and Practices at Woman's Health Center, Assiut University Hospital, and revealed that the mean age of the sample was 23 years

old (***28***). As well, results agree with another study carried out in Egypt. Which stated that, the highest percentage of nurses was between the ages of 20: 30 years ***(29).***

Considering years of experience, more than half of nurses under study had 1-5 years of experience, this may be attributed to that the highest age group of the studied nurses are in a young age group and their ability to change both in information and practices will be better and faster. These results come in accordance with those of study done in Egypt, Which studied (Effectiveness of Infection Control Standards on Practice among Health Care Personnel Working in MCH Centers at Quena Governorate) and showed that the majority of them their experience was less than 5 years. **(*29*)**.

As regards training courses related to maternal sepsis, the majority of the studied nurses didn't receive any training courses regarding maternal sepsis. This result was similar to that of **Gajec et al**., (***30)*** who studied (Knowledge and Attitudes of Health Care Workers from Primary Health Care Centers in India, Serbia, on Professional Exposures to Blood–Borne infections) and found that 49 % of the participants have never had any education on this topic, while 22 % had been educated during the last five years.

According to the current study finding, the majority of nurses' knowledge was unsatisfactory regarding maternal sepsis before implementation of management protocol. These were evident in all areas of related knowledge and indicated lack in in service training courses regarding maternity sepsis and lack desire to reading and refreshing their knowledge also lack of knowledge of novelty. In accordance, the United States National Center for Biotechnology Information **(31)**, stressed that, despite four-fifths of nurses having had skilled birth attendant training, knowledge was very poor.

On the other hand, implementation of the management protocol for nurses under study led to significant improvements in nurses' knowledge, this improvement is certainly attributed to the content and process of the protocol, which was individualized according to nurses needs. This result is contradicting with those of a study carried out by ***Rammohan et al. (32***), who studied (Reducing Neonatal Mortality in India: Critical Role of Access to Emergency Obstetric Care) and mentioned that no Difference between the 80% of staff who had attended skilled birth attendant training and the 20% who had not, also they stated that, knowledge of appropriate drugs for maternal puerperal sepsis and neonatal infections was very low.

Additionally, this study result is incongruent with that of the study of **Bayley (*33)*** entitled (Knowledge and Perceptions of Quality of Obstetric and Newborn Care of Local Health Providers: A Cross-sectional Study in Three Districts in Malawi) who concluded that training had little impact on levels of knowledge and the gap of knowledge couldn't be overcome by simply providing more training, so most of staff reported perception of poor quality of care.

On the other hand, these study findings agree with those of study of ***Abdelhalem and Said, (34***). Egypt, whose study entitled (Developing Nursing Management Protocol for Maternity Nurses Regarding Emergency Obstetric Care), which revealed that, 88.75% of the studied nurses have unsatisfactory knowledge before protocol compared to 75.75% after protocol have satisfactory knowledge respectively. Furthermore, this study results also agree with those of study of ***Brenner et al. (35),*** who reported that, training health-care providers in obstetric emergency and newborn care concentrate on the need to build the capacity of health-care providers to recognize and manage complications during pregnancy, labor and the post-partum period through providing skills and competency-based training in skilled birth attendance, emergency obstetric care and early newborn care which is considered an approach that was successful in improving skills and improved availability and quality of care.

Concerning management of puerperal sepsis this study findings revealed highly statistically significant differences between before/after protocol implementation. This result contradicted with that of Kavitha et al ***(36)***, who assessed the level of knowledge of staff nurses on emergency obstetric management at Orotta national referral maternity hospital. They stated that the knowledge score regarding puerperal sepsis management among 60 staff nurses, 68.3% of the staff had adequate knowledge regarding puerperal sepsis management

Moreover, the current study finding demonstrated unsatisfactory total knowledge before management protocol compared to after management protocol. This may be attributed to that nearly three fifth of the studied sample their age ranged from 20-<30 years and also due to more than half of them had 1-5 years of experience this study findings are congruent with those of a study conducted in American, which mentioned that the nurses over the ages of 40 were found to be more likely to believe they were competent to provide such education regarding postpartum complications and warning signs to the mothers as they were discharged from the hospital ***(37***).

Considering practices toward maternal sepsis, the result of the present study clarifies that there was highly statistically significant differences before/ after

management protocol during maternal sepsis in obstetric and general procedure, including ABC of resuscitation and temperature management of vaginal bleeding and infection control measures this may be due to improved practices and refreshed knowledge and that nurses under study are aware of the importance and methods of infection control as well due to effectiveness of the management protocol.

This result was similar to that of Belleza (***38),*** which revealed that, strict infection control practices prevent the invasion of microorganisms inside the body; infection must be put at bay through effective aseptic techniques and interventions and stated that vital signs report demonstrates that there are opportunities to better prevent infections and recognize sepsis early to save lives.

Regarding urinary catheter care and perineal care, this study findings revealed improved practices after compared to before implementation of management protocol. This improvement may be due to suitability of the management protocol items. This result was similar to that of the ***Wound, Ostomy and Continence Nurses Society (39)***, In Mount Laurel, which revealed that morbidity from UTI with short-term catheter use is limited if appropriate catheter care is practiced.

Regarding management of septic shock, it is very important to detect the puerperal sepsis; the present protocol had influence on the practical competence level of nurses under study. This result is similar to that of ***Sinha and Otify* (*40),*** in UK, which stated that, in cases of septic shock, critical care management involves the administration of intravenous antibiotics within one hour and resuscitation with fluids. According to the 2005 Surviving Sepsis Campaign guideline, each hour of delay in starting appropriate antibiotics decreases the chance of survival by 7.9%. So, there is a clear need to raise both maternal and professional awareness about genital tract sepsis so, that it can be prevented and, where possible, recognized quickly and managed effectively and immediately.

The current study results reveals highly positive statistically significant correlations between total nurses' knowledge score regarding nursing care of maternal sepsis and between age and years of experience, which may be due to that their age ranged between 20-<30 years the suitable age to receive and understand information as well as the suitable age for changeability and practical improvement. As well, nurses who have 1-5 years of experience, after management protocol implementation, improved their knowledge and because of their young age, this has claimed a rapid change in information. This study finding disagree with those of the study of ***Kavitha et al (36)*** in Eritrea, who stated that, all demographic variable as age, sex, marital status, professional qualification, and experience in maternity, had no association with knowledge regarding emergency obstetric management.

However, this study results are similar to those of the study of (***Abdelhakm and Said (34),*** in Egypt, who studied (Developing Nursing Management Protocol for Maternity Nurses Regarding Emergency Obstetric Care), which showed that there was a highly positive statistically significant correlation between knowledge and age before and after protocol. As well, there was a highly positive statistically significant correlation between knowledge and years of experience before and after protocol.

In addition , the current study displays highly positive statistically significant correlations between practices and age, years of experience before and after management protocol, this may be due to the young age has the ability to practice better and those who have five years of experience are able to practice well. This study findings are similar to those of the study of ***Abdelhakm and Said (34), in*** Egypt, who stated that, there was positive statistically significant correlation between practices and age before and after training.

Moreover, there was a positive statistically significant correlation between practices and years of experience before and after management protocol .This result disagrees with that of Attia (***41), in Egypt***, whose Master thesis entitled (Assessment of Emergency Nursing Care Offered at the Labor Ward of Ain Shams Maternity University Hospital, who found that there was no statistically significant relation between nurses' performance and their age.

The implementation of the management protocol in the present study revealed statistically significant correlation between knowledge and practices. This finding is in agreement with that of ***Abdelhakm and Said (34), in*** Egypt, who found statistically significant correlation between total scores of nurses' knowledge, and practices before and after nursing management protocol.

To summarize, the results of this study support the study hypothesis that the nurses' management protocol has a positive effect on nurses' knowledge and practices regarding early recognition of maternal sepsis.

V. Conclusion

Nurses' management protocol has a positive effect on nurses' knowledge and practices regarding early recognition of maternal sepsis. There were significant improvements in nurses' knowledge and practices regarding early recognition of maternal sepsis after nursing management protocol implementation compared with that before it. There were positive correlations between nurses' knowledge and practices before and after protocol in relation to their age and years of experience and practices after protocol. The study findings support the research hypothesis.

VI. Recommendations

Based on the study findings, the following recommendations can be suggested:

- Simple guidelines regarding maternal sepsis nursing care can be available for nurses in the Obstetric and Gynecology Department and Intensive Care Units.
- Continuous refreshment courses and follows up programs for nurses regarding maternal sepsis care are required.
- Further studies: Development periodical training and teaching programs regarding maternal sepsis nursing care

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