

Clinical Practice Guidelines for Prevention of Central Line Infection

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Abstract:

Background: Improving patient safety, reducing and preventing central line –related infection especially in the intensive care unit are now a priority for hospitals. Therefore; nurses play an integral role in preventing infections. **Aim of the study** is to develop guidelines for prevention of central line infection and examine the effect of implementation of those guidelines on the nurses' knowledge and practice. **Setting:** The present study was conducted in intensive care unit of New Surgical Hospital affiliated to Zagazig University Hospitals. **Sample:** The study sample was included 40 nurses who are working in the above mentioned setting. **Tools:** Two tools were used for data collection which includes questionnaire sheet and observational checklist. **Results:** The study results revealed that prior to guidelines implementation; majority of nurses had unsatisfactory knowledge score and practice. In post guidelines, the findings pointed out to significant improvement. There was a statistically significant correlation between knowledge and practice score. **Conclusion:** Nurses' knowledge and practice improve after implementation of the guidelines for prevention of central line infection. **Recommendations:** Provision of continuous education and guidelines for prevention of central line infection, all needed equipment and supplies and further studies to examine the impact of guideline on patients' outcomes are required.

Keywords: Guidelines, Prevention, Central line infection

Introduction:

Healthcare-associated infection affects hundreds of millions of people worldwide and is a major global issue for patient safety. It complicates between 5 and 10% of admissions in acute care hospitals in industrialized countries. In developing countries, the risk is two to twenty times higher and the proportion of infected patients frequently exceeds 25%.⁽¹⁾

Central venous catheters are an invaluable tool in the medical field for use in treating a variety of illnesses.⁽²⁾ Central venous cannulation is associated with many complications.⁽³⁾ Catheter-related bloodstream infections are associated with significantly increased morbidity, mortality, and expenditures. Such infections are a serious threat to patient safety in the intensive care unit.⁽⁴⁻⁶⁾ Device-associated healthcare-associated infections in the ICUs in

Egypt pose greater threats to patient safety than in industrialized countries.⁽⁷⁾

Patient safety is a serious concern all over the world.⁽⁸⁾ Infection prevention and control practice is an essential component of care.⁽⁹⁾ The prevention and control of Central line-associated bloodstream infections in limited-resource countries needs to be widely and adequately addressed to reach the standard levels in developed countries.⁽¹⁰⁾ It is important to raise awareness of infection prevention and risk reduction strategies for preventing nosocomial infections like central line associated blood stream infections.⁽¹¹⁾ Minimizing catheter-related bloodstream infections (CRBSIs) continues to be a major focus for clinicians and healthcare institutions. There are three reasons for this, all of

them related: First, CRBSIs are potentially life-threatening. Second, they dramatically increase healthcare costs and other forms of financial risk. Third, many experts consider CRBSIs largely preventable when certain evidence-based practices and technologies are instituted.⁽¹²⁾

Ensuring the use of safe, effective and ethical infection prevention and control measures is an important component of nursing care.⁽¹³⁾ The role of the professional nurse in preventing health care-associated infection is significant.⁽¹⁴⁾ Critical care nurses are the health care professionals who have the obligation to protect critically ill patients against infection especially those who are immune compromised, in order to enhance their recovery, prevent deterioration in their health, and achieve high quality nursing care. Therefore critical care nurses should have sound knowledge and strict adherence to infection control standard precautions.⁽¹⁵⁾

Healthcare workers caring for a patient with a central venous access device need to be adequately trained, and assessed as being competent in using central venous catheters and adhering to infection prevention practices.⁽¹⁶⁾ Adequate knowledge of nurses in taking care of central venous pressure line plays vital role to minimize complications and to accurately recognize catheter-related problems, thus securing safer and improved outcome for the patient.⁽¹⁷⁾ In Egypt, infection control programs, including surveillance and guidelines, must become a priority.⁽⁷⁾

Significance of study:

According to US CDC, between 12 and 25% of patients who acquire catheter related blood stream infections die; many others have extended hospital stays, and increased overall treatment costs. Each year in the United States, central venous

catheters may cause an estimated 80 000 catheter-related bloodstream infections in ICUs. A total of 250 000 cases of blood stream infections have been estimated to occur annually if entire hospitals are assessed and, as a result, up to 62 000 deaths among patients in hospitals. A single incident of catheter related blood stream infections can cost as much as US\$ 56 000 to treat according to some studies, once the cost of pharmacy charges, catheter changes, lab tests and an additional day in the ICU are added up.⁽¹⁸⁾

Education and training of health professionals on the practice of dealing with the CVC is an important tool in preventing and reducing catheter related infections.⁽¹⁹⁾ In addition, the prevention and control of Central Line-Associated Bloodstream Infections in limited-resource countries needs to be widely and adequately addressed to reach the standard levels in developed countries.⁽¹⁰⁾ According to a study about nurses' performance regarding infection for patients with central venous catheter in Zagazig University Hospitals; the result revealed that nurses' knowledge and practice regarding central venous catheter and prevention of infection were unsatisfactory.⁽²⁰⁾

Therefore, the present study is an attempt to move forward to reduce the potential for central line infection.

Aim of the study:

The aim of the present study was to examine the effect of implementing guidelines for prevention of central line infection on nurses' knowledge and practice.

Research Hypothesis:

Nurses' knowledge and practice improve after implementing of the guidelines for prevention of central line infection.

Subjects and methods:**Research design**

A quasi- experimental study design was used in the study.

Setting:

The present study was conducted at the intensive care unit of New Surgical Hospital affiliated to Zagazig University Hospitals. The unit contains 25 beds.

Subjects:

A purposive sample of 40 nurses who met the inclusion criteria which were provision of direct patients care, having a work experience at least one year in the ICU and acceptance to participate in the study.

Tools of data Collection:

The data collection tools for the current study were composed of two tools, a questionnaire sheet and an observational checklist.

Tool (1): Nurses' questionnaire sheet: The questionnaire sheet was constructed by the researcher in Arabic form. It was guided by review of related literature and consists of 49 questions and was composed of 2 parts as following:

Part (1): the first part concerned with:

- A. Personal characteristics of the study subjects such as: age, marital state, qualifications, years of experience and studied central line infection prevention (5 questions).
- B. Infection control activities in the hospital (4 questions) which includes; availability of infection control committee, infection control workshop, Seminars and booklets.
- C. Availability of equipment's in the unit (18 Questions).

Part (2): It was in the form of multiple choice questions for the purpose of assessment of nurses' knowledge related to prevention of central line

infection. It was classified under 2 main sections:

- **Section (A):** It consists of 5 questions. It entailed knowledge about central line infection and its associated risk factors.
- **Section (B):** It consists of 17 questions about prevention of central line infection.

Scoring system:

Scoring system for knowledge was done by giving a score of one for each correct answer and zero for incorrect answer. Scoring for practice was done in such a way that the step was done giving one score and that not done step was scored zero.

The level of knowledge was considered satisfactory when it was equal or exceeded 60% and was considered unsatisfactory when it was less than 60%.

Tool (2): Observational checklist:

A clinical observational checklist was constructed by the researchers based on the literature of nursing review guided by Potter and Perry, ⁽²¹⁾ Taylor, Lillis and Lemone ⁽²²⁾ and Taylor, Lillis, Lemone and Lynn. ⁽²³⁾ The checklist was required to assess nurses' practice related to prevention of central line infection total 133 items. It includes eight nursing procedures which are: routine hand washing (13 items), surgical hand washing (23 items), putting on a face mask (5 items), putting on a sterile gown (10 items), putting on sterile gloves (16 items), removing sterile gloves (7 items), nurse's role before, during and after insertion the central venous catheter (21 items) & care for central line catheter (37 items).

Scoring system:

The level of practice was considered satisfactory when it was

equal or exceeded 75% and was considered unsatisfactory when it was less than 75%.

Guidelines for prevention of central line infection:

The guidelines was designed by the researchers in Arabic in the light of related literature based on identified nurses' knowledge and practice needs using the study tools in the assessment phase. The guidelines consisted of two main parts:

- **The first part:** included knowledge about central line infection and its associated risk factors and prevention of central line infection.
- **The second part:** covered procedures of routine hand washing, surgical hand washing, putting on a face mask, putting on a sterile gown, putting on sterile gloves, removing sterile gloves, nurse's role before, during and after insertion the central venous catheter and care for central line catheter.

Content validity:

Content validity was achieved by a panel of five experts who revised the tools and guidelines for clarity, relevance, comprehensiveness, understanding and ease for implementation. Modifications were applied according to their opinions.

Pilot study:

A pilot study was carried out on 10% of the sample, and was later excluded from the sample. The purposes of the pilot study were to test the clarity and applicability of the study tool and to determine the time needed to complete the questionnaire sheet for each participant.

Field work:

The field work was performed

over a period of three months started from February to April 2013.

- **Assessment phase:** the purpose of the study and the schedules of appointment were explained to that nurses who willing to participate. Nurses fill out the questionnaire sheet in the morning and afternoon shifts. The time taken for filling out the questionnaire sheet varied between 15- 20 minutes. Also, nurses' practice were assessed.
- **Implementation phase:** Total number of the studied sample was 40 nurses. It was difficult to take all nurses at the same time. Thus, they were divided into eight groups each group contains five nurses in every session. The researcher met every group four sessions. One session for theory and three sessions for practice (hand washing, sterile barrier precautions and nurses' role and care of catheter). Each session lasted for two hours. The guidelines have been implemented through 32 sessions. The teaching methods included lectures by laptop, demonstration and real application on patients. A guideline booklet was prepared and distributed to participants.
- **Evaluation phase:** The evaluation was done immediately after implementing the guidelines by using the same tools of data collection to evaluate nurses' knowledge and practice.

Administrative and ethical considerations:

An official permission letter was issued from the Dean of Faculty of nursing to the chief administrator of Zagazig University hospital to request permission and cooperation to conduct the study. Nurses' oral consents were obtained before starting data

collection. The aim of the study was explained to all participants. They were assured about confidentiality and anonymity of the study. They were informed about their right to refuse or withdraw from the study at any time without giving a reason.

Statistical design:

The data were analyzed by using SPSS (Statistical Package for Social Sciences) soft-ware program version 15, which was applied to frequency tables. Statistical significance and association were assessed using chi-square test. To detect the relation between the variables P value, number and percentage, mean and standard deviation were used. A significant level value was considered when $p \leq 0.05$.

Results:

Table (1): Shows the personal and job characteristics of study sample. According to the table the age of the studied sample ranged between 21-37 years old. 67.5% were married. 57.5% had nursing diploma. Also, 47.5% had a working experience less than five years with same percentage of them had a working experience less than 10 years. The mean of year of experience was 5.30 ± 2.39 years.

The table also clarifies that 50% had studied prevention of central line infection. In relation to hospital infection control activities, 92.5% reported presence of infection control committee in the hospital while most of them reported that infection control workshop, seminars and guidelines booklet were not provided by the hospital (57.5%, 75% & 70% respectively).

Figure (1): Presents total availability of equipment's and supplies as reported by the studied nurses. The figure illustrated that the majority of equipment's (90%) were inadequate.

Figure (2): Shows total nurses' knowledge score regarding prevention of central line infection. 7.5% had satisfactory knowledge score before guidelines implementation. Conversely, after guidelines implementation, the findings revealed improvement of knowledge level, where most of studied nurses (87.5%) had satisfactory knowledge score.

Table (2): Displays satisfactory knowledge scores level of central line infection and risk factors in the studied sample. The minority of studied nurses had satisfactory knowledge in relation to central line catheter and risk factors and prevention of central line infection (10% & 15% respectively) pre-guidelines. After implementing of guidelines the most of them had satisfactory knowledge (85% & 92.5% respectively). There were statistical significance relations in all studied items ($p=0.000$).

Figure (3): Demonstrates total nurses' practice scores regarding prevention of central line infection in the study sample. 7.5% had satisfactory total practice score before guidelines implementation. Whereas, 77.5% had satisfactory total practice score after guidelines implementation ($p=0.000$).

Table (3): Presents nurses' practice scores regarding prevention of central line infection in the study sample. Studied nurses obtained satisfactory scores in relation to all items of prevention of central line infection before guidelines implementation. Pre guidelines implementation more than two third of them had satisfactory scores regarding different items related to prevention of central line infection. As for post-guidelines scores, they have shown statistically significant improvement, in comparison with pre-guidelines scores in all items practice ($p=0.000$).

Table (4): Presents correlations between knowledge and practice scores pre and post guidelines. There are statistically significant correlations between knowledge and practice score pre and post the guidelines ($p=0.000$).

Discussion:

The current study findings showed that most of studied nurses reported availability of infection control committee whereas less than half of them reported availability of infection control workshop, seminars and guidelines booklet by the hospital. This might be due to absence of hospital's staff development plan and inactive infection control committee. These findings are similar to other study findings which reported that each hospital should have infection control committee.⁽²⁴⁾ Limited local and national policies and guidelines.^(25, 26) Moreover, another study done in the same study setting pointed out that the most of studied nurses reported the absence of booklet about infection control at unit.⁽²⁷⁾ On the other hand, Nurses must be educated on the correct procedures and rationale for insertion and placement as well as for the care and maintenance of each specific device.⁽²⁸⁾

Appropriate education, training, and competency assessment resources are needed for all staff responsible for the insertion and maintenance of central venous catheter. Furthermore, health care organizations should have written policies and procedures that incorporate evidence-based practices. These policies should describe how recommended practices are translated into actual practices and processes at the bedside.⁽²⁹⁾

Interventions designed to improve safety climate, as well as availability of necessary infection control supplies and equipment will most likely prove effective in

improving employee compliance with infection control practices in healthcare setting.⁽³⁰⁾ In this context, the present study findings indicated that, the majority of equipment and supplies which are needed for prevention of central line infection were inadequate. This finding agrees with a study done in the same study setting which reported that there were shortage of equipment and supply⁽³¹⁾ while contradicts with The Joint Commission⁽²⁹⁾ which confirmed that health care personnel must have ready access to the supplies and equipment necessary for the proper insertion and care of central venous catheters.

Assessment of the knowledge of the studied nurses about central line infection prior to guidelines implementation has shown that the majority of them had unsatisfactory knowledge score. This might be due to lack of opportunity for infection control workshop, seminars and guideline booklet availability in the hospital. Also, more than half of studied nurses had nursing diploma and only half of studied sample had studied prevention of central line infection. This finding is supported by a study done in Zagazig University Hospitals which reported that the nurses' knowledge about central venous catheter and its related infection were below satisfactory level.⁽²⁰⁾

These results were similar to those of Csomós et al.,⁽³²⁾ who reported poor knowledge regarding central venous catheter related infection among Hungarian nurses and findings of Lourenço and Ohara⁽³³⁾ who reported inadequacy of nurses' knowledge. While disagree with European survey of 3,405 ICU nurses⁽³⁴⁾ and those reported by Para et al.,⁽³⁵⁾ who found that the initial knowledge of ICU workers about guidelines was good. In addition, Health care personnel who insert or maintain CVCs must clearly

understand their indications for use and the potential for complications, as well as the evidence-based practices that should be part of all CVC insertion and maintenance procedures.⁽²⁹⁾

Post guidelines findings pointed out to significant improvement. This finding seems logic when compared to pre-guidelines, nurse patient ratio and work pressure may limit nursing staff time to read. Therefore, they were highly receptive and interested in acquiring knowledge when engaged in the guidelines. These findings go in the same line with Yilmaz et al.,⁽³⁶⁾ and Shrestha,⁽¹⁷⁾ who identified a significant increase in knowledge after training. Also, educational intervention plays an important role in increasing nurse's level of knowledge.

Nurses have the unique opportunity to reduce the potential for hospital-acquired infections.⁽¹⁴⁾ All health care professionals who have a clinical responsibility for patients must include infection prevention and control as part of their every day practice.⁽³⁷⁾ In this regards, the present study revealed that the minority of studied nurses had satisfactory total practice score before guidelines implementation This result may be attributed to decline of nurse's knowledge, limited resources and training and burden of work. These finding is in harmony with, Abd-el monem⁽²⁰⁾ who reported that nurses' level of practice regarding care of central venous catheter was unsatisfactory and Al-Sayaghi⁽³⁸⁾ who reported Lack of consistent adherence to evidence based guidelines for prevention of intravascular catheter related infection. While contradicts with finding of Eskander⁽¹⁵⁾ who found satisfactory performance level of critical care nurses regarding infection control standard precautions.

There is growing recognition that many hospital acquired infections

including central Line-associated bloodstream infections are largely preventable when evidence based practices are followed consistently.⁽²⁹⁾

A focused intervention primarily directed at the ICU nursing staff can lead to a dramatic decrease in the incidence of primary bloodstream infections.⁽³⁹⁾ Education programs may lead to a substantial decrease in medical-care costs and patient morbidity attributed to central venous catheterization when implemented as part of mandatory training.⁽⁴⁰⁾ In this respect, the post guideline scores have demonstrated statistically significant improvement in all items of nurses' practice regarding prevention of central line infection. This finding is in harmony with Suchitra and Lakshmi Devi⁽⁴¹⁾ who reported a positive impact of education on practice.

The current study showed that there is statistically significant correlation between nurses' knowledge and practice pre and post guideline. This finding goes in line with Zatton⁽⁴²⁾, Abd-Elmnem⁽²⁰⁾ who found that significant correlation was found between knowledge and practice. While disagree with Abd El-Aziz⁽²⁷⁾ who reported that there is no statistical significant correlation was detected between nurse's knowledge and practice. Furthermore, An educational intervention in central venous catheter insertion significantly improved patient outcomes.⁽⁴³⁾ Also, education and training of health professionals on the practice of dealing with the central venous catheter is an important tool in preventing and reducing catheter related infections⁽¹⁹⁾

Conclusion:

In the light of the main study findings, it can be concluded that: Nurses' knowledge and practice were improved after implementing of prevention guidelines of central line

infection.

Recommendations:

In the light of the main study findings, the following recommendations can be suggested:

- Nurses' knowledge and practice about prevention of central line infection should be updated through continuous education.
- Guidelines about central line catheter should be available in the intensive care units (ICUs) and updated regularly.
- Further research is required to study the impact of the guidelines about prevention of central line infection on patients' outcome.

Table (1): Personal and job characteristics of the studied nurses (n=40)

Item	No.	%
Age		
▪ <25	8	20.0
▪ 25-	25	62.5
▪ >30	7	17.5
Range	21-37	
Mean ±SD	26.90± 3.691	
Marital status:		
▪ Single	13	32.5
▪ Married	27	67.5
Qualifications		
▪ Nursing diploma	23	57.5
▪ Diploma and specialty	2	5.0
▪ Technical institute	15	37.5
Years of experience		
▪ <5	19	47.5
▪ 5-10	19	47.5
▪ >10	2	5.0
Mean ±SD	5.30±2.39	
Studied central line infection prevention practice		
▪ Yes	20	50
▪ No	20	50
Hospital infection control activities:		
Infection control committee		
▪ Yes	37	92.5
▪ No	3	7.5
Infection control workshop		
▪ Yes	17	42.5
▪ No	23	57.5
Infection control seminars		
▪ Yes	10	25
▪ No	30	75
Guideline booklets:		
▪ Yes	12	30
▪ No	28	70

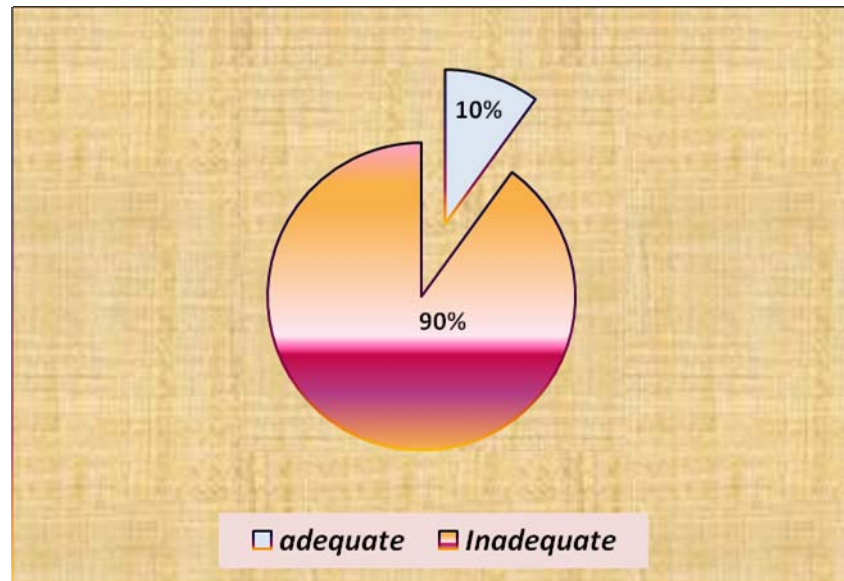


Figure (1): Total availability of equipments and supplies as reported by the studied nurses

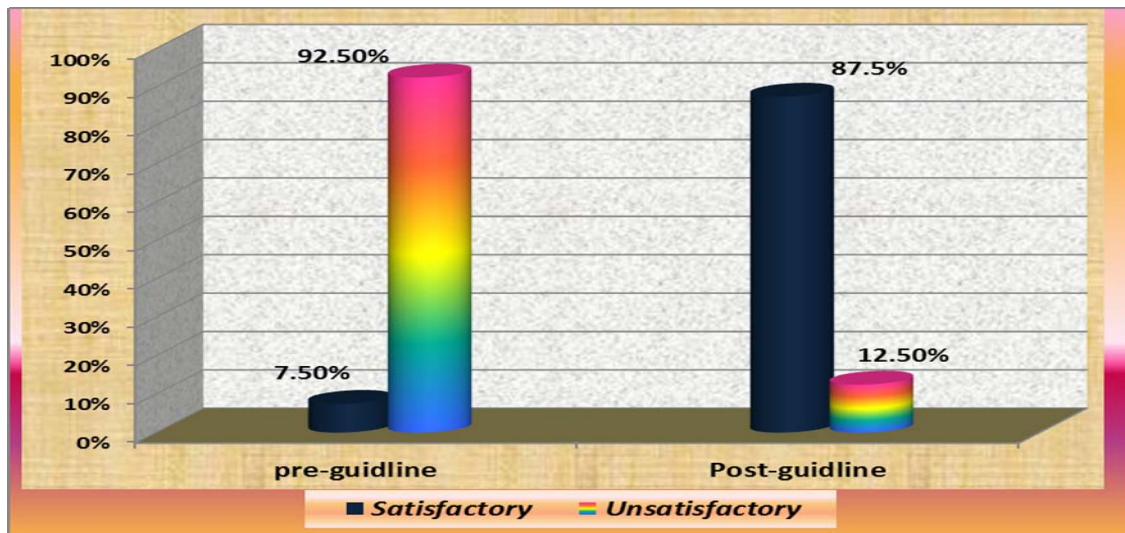


Figure (2): Total nurses' knowledge score regarding prevention of central line infection

Table (2): Satisfactory knowledge scores level of central line infection and risk factors in the studied sample (n=40)

Item	pre		Post		X ²	P- value
	Satisfactory >60%		Satisfactory >60%			
	No.	%	No.	%		
Central line catheter and risk factors	4	10	34	85	25.18	0.000**
Prevention of central line infection	6	15	37	92.5	18.37	0.000**

* P value < 0.05

** P value < 0.001

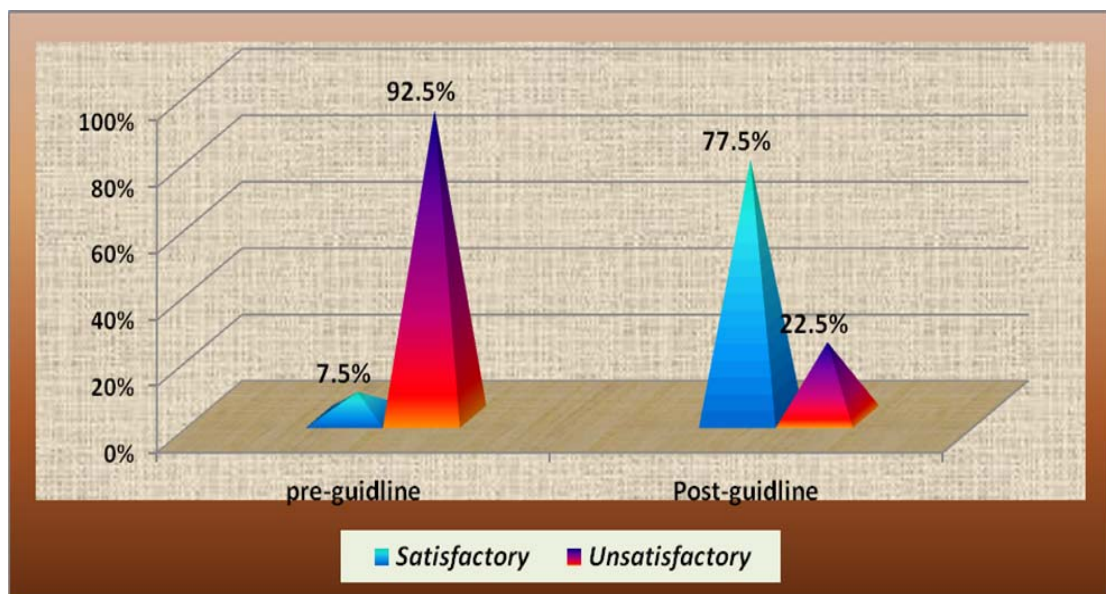


Figure (3): Total nurses' practice scores regarding prevention of central line infection in the study sample (n=40)

Table (3): Nurses' practice scores regarding prevention of central line infection in the study sample (n=40)

Items	pre		Post		X ²	P- value
	Satisfactory >75%		Satisfactory >75%			
	No.	%	No.	%		
▪ Routine hand washing	4	10.0	29	72.5	32.23	0.000**
▪ Sterile gloves	3	7.5	27	67.5	30.72	0.000**
▪ Face mask	2	5.0	29	72.5	38.39	0.000**
▪ Sterile gown	2	5.0	30	75.0	40.83	0.000**
▪ Surgical hand washing	3	7.5	28	70.0	32.91	0.000**
▪ Removing used gloves	3	7.5	31	77.5	40.10	0.000**
▪ Central line insertion	3	7.5	28	70.0	32.91	0.000**
▪ Care for central line catheter	4	10.0	31	77.5	37.02	0.000**

* P value <0.05

** P value < 0.001

Table (4): Correlation between knowledge and practice score pre and post guidelines

Variable	Time of assessment	Total practice score		
		pre -guideline	Post-guideline	
Total knowledge score	pre -guideline	r	.520	.153
		P value	0.000**	0.345
	Post-guideline	r	.126	.520
		P value	0.349	0.000**

* P value <0.05

** P value <0.001

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