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Nurses' Performance Regarding Prevention of Surgical Site Infection for Patients after Neurosurgery

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Abstract

Background: Surgical site infections (SSIs) post neurosurgery are the most commonly encountered healthcare associated infections among neurosurgery treated patients. Nursing performance means nurses knowledge and practice. **Aim**: This study aimed to assess nurses' performance regarding prevention of surgical site infection for patients after neurosurgery. **Research design**: A descriptive exploratory design was utilized to conduct the study. **Setting:** The current study was conducted at neurosurgical word Menoufia University Hospital **Sample**: The study sample included a convenient sample of 100 nurses who worked at previous mentioned setting and provided care for patients after neurosurgery. **Tools:** Two tools were used in this study. **Tool 1:** Nurses' self-administered questionnaire that included 2 parts concerned with Nurses' personal data and Nurses' knowledge regarding prevention of surgical site infection. **Tool 2:** Observational check list. **Results:** 82% of studied nurses were female and 84% received training within the last two years, 68% of nurses demonstrated satisfactory level of knowledge and 62% studied nurses had total competency level across of all practices. **Conclusion:** More than two third of studied nurses had satisfactory total knowledge level regarding prevention of surgical site infection for patient after neurosurgery , while more than three fifth had total competency level across all practices level regarding prevention of surgical site infection for patient after neurosurgery. Also, there was strong positive correlation between total knowledge and total practice among studied nurses. **Recommendations**: Conducting training program for nurses to enhance their awareness and to help the nurses to improve their performance regarding prevention of surgical site infection for patient after neurosurgery.

Key words: Neurosurgery, Nursing performance, Surgical Site Infections

1. Introduction

Surgical site infections (SSIs) are a significant concern in postoperative care, especially following neurosurgical procedures. SSIs not only compromise patient recovery but also lead to extended hospital stays, increased healthcare costs, and higher morbidity and mortality rates. Nurses play a pivotal role in preventing SSIs, as they are directly involved in patient care throughout the perioperative period. Their actions, from preoperative preparation to post-surgical monitoring, are essential in reducing the risk of infection **(Patel & Nguyen, 2024).**

This study focuses on nurses' performance in preventing surgical site infections after neurosurgery, examining the strategies they employ to minimize infection risk and enhance patient outcomes. Given the complexity and delicacy of neurosurgical procedures, the management of surgical wounds, aseptic techniques, patient education, and the monitoring of early signs of infection are critical areas where nursing interventions can have a profound

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impact. By exploring the current nursing practices, identifying potential gaps in knowledge or performance, and assessing the effectiveness of existing infection prevention protocols, this research aims to highlight the importance of improving nursing strategies in the prevention of SSIs. Understanding the role of nurses in this context is crucial to enhancing patient safety and optimizing recovery following neurosurgery **(Kassa & Gedefaw, 2022).**

Surgical site infections (SSIs) were associated with intrinsic factors including, especially for high-risk surgeries such as neurosurgery. Patient-related factors: Age, comorbidities, nutritional Status, Smoking, poor Hygiene and previous infections immune system function: Surgical-related factors: Length of Surgery, Type of Surgery, use of Implants or Foreign Devices, Inadequate Sterile Technique, Contaminated Surgical Instruments or Environment, Surgical Technique. Healthcare-related factors: Inadequate postoperative care, antibiotic use, operating room environment, healthcare worker hygiene and training and hospital or surgical Facility cleanliness. Microbial factors: Bacterial contamination and Biofilm Formation. Environmental factors: Air quality in operating rooms, infection control protocols, prevention strategies, Preoperative screening and optimization of patients, Prophylactic antibiotics, strict aseptic technique, Proper surgical wound care and Patient education **(Méric & Ntemiri, 2021).**

Throughout the literature, SSIs were associated with intrinsic factors including advanced age, malnutrition, metabolic diseases, smoking, obesity, hypoxia, immune-suppression, and length of preoperative stay. Moreover, extrinsic factors like application of skin antiseptics, preoperative shaving, antibiotic prophylaxis, preoperative skin preparation, inadequate sterilization of instruments, surgical drains, surgical hand scrubs, and dressing techniques were among the most frequently reported risk factors **(Nusair et al., 2020).**

Patients undergoing neurosurgery are exposed to several factors which can predispose to a surgical-site infection (SSI). Infections in the post craniotomy period are of particular interest for neurosurgeons and include a wide spectrum of entities namely superficial and deep wound infection, meningitis, empyema and abscess, and bone flap infection. In particular, those that require reoperation and prolong length of stay can have a significant negative impact on hospital care, on financial cost, and on the patient himself. Therefore, special emphasis should be placed in their prevention **(McFarland, et al., 2020).**

Understanding the incidence and pathophysiology of surgical site infections (SSIs) is the key to prevention. SSIs can range from superficially infected dehiscence to life-threatening conditions. The impact on the patient's subjective well-being is always negative and significant, and the management requires considerable expenses for the healthcare systems. A previous study found that patients who developed a SSI were twice as likely to die, 1.6 times as likely to require intensive care treatment, and more than five times as likely to be readmitted to the hospital **(Zhou et al., 2020).**

The World Health Organization (WHO), in its guideline for safe surgery, has set a number of recommendations regarding the prevention of SSIs. According to this guideline, highly recommended practices to prevent SSIs include routine use of prophylactic antibiotic within 60 minutes prior to skin incision, the use of sterility indicators during sterilization of surgical instruments, presurgical skin disinfection, and the implementation of surgical safety checklist **(Rubeli et al., 2019).**

According to the literature, factors associated with knowledge and practice of nurses towards the prevention of SSIs include but are not limited to work experience, level of nursing education, work load, training on infection prevention mechanisms, and non-adherence in

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infection prevention and patient safety guidelines. In some studies, insufficient utilization of available evidences was also observed **(Patel et al., 2019).**

Nurse role in preventing SSIs is comprehensive and spans the continuum of care. Nurse plays a crucial part in executing or promoting implementation of evidence-based practices. For example, provide counseling and education during the initial preoperative visit, especially related to smoking cessation and glucose control in patients with diabetes. Encourage patients to report new rashes, breaks in skin integrity, and new-onset respiratory infections before surgery **(Kołpa, et al., 2019).**

Significance of the study:

The incidence of SSIs in neurosurgery can vary but typically ranges from 1% to 10% depending on the type of procedure and patient risk factors. Strict adherence to infection prevention protocols and proper postoperative care can help reduce these rates. Recent data and studies on SSI rates found that the rate of SSIs in neurosurgical patients was 3.5% for cranial surgeries and 7.8% for spinal surgeries and another reported that the incidence of SSIs in neurosurgery ranged from 2% to 6% in clean spinal surgeries, while more complex procedures showed rates closer to 10**% (Barker & MacLennan, 2020; Sood & Bansal, 2023).**

Aim of the study:

This study aimed to assess nurses' performance regarding prevention of surgical site infection for patients after neurosurgery after neurosurgery, through the following objectives:

- Determine how knowledgeable nurses are about preventing surgical site infections in neurosurgical patients.
- Assess nurses' level of practice regarding prevention of surgical site infection for patient after neurosurgery.

Research Questions:

- What is the level of nurses' knowledge regarding prevention of surgical site infection for patient after neurosurgery?
- What is the level of nurses' practice regarding prevention of surgical site infection for patient after neurosurgery?
- Is there relation between nurses' knowledge and practice regarding prevention of surgical site infection for patient after neurosurgery?

Subjects and Method:

Research Design:

A descriptive exploratory research design was used to conduct this study.

Setting:

The current study was conducted at neurosurgical word Menoufia university Hospital. The neurosurgical word located in 8 floors and divided in two halls; every hall contains 12 beds.

Sample:

The study sample was included a convenient sample of 100 nurses who worked at previous mentioned setting and provided care for patients after neurosurgery.

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Tools of data collection:

Two tools will be used in this study; Tool I: - Nurses' Self-Administered Questionnaire:

It was developed by the investigator after reviewing the related literature. It was written in a simple Arabic language for gathering data in relation to the following parts:

Part I: It was designed to collect data about: Nurse's personal data involved in the study. It included 5 items (age, gender, marital status, level of education, experience).

Part II: It was concerned with: Nurse's knowledge regarding prevention of surgical site infection involved in the study. It included 30 items (surgical site infection definition, infection classification of a surgical patient develops a wound infection during hospitalization, symptoms of surgical site infection, Risk factors as old age, use of synthetic suture, prolonged preoperative admission , failure to use prophylactic antibiotic, poor preoperative preparation, obesity, percentage of surgery patients develop a surgical site infection, the most common health care acquired infection among hospitalized patients, The mortality rate of surgical site infection, days number after an operative procedure at which a surgical site infection can occur, the average additional length of stay in the hospital for patients that develop a surgical site infection, the estimated number of surgical site infection that are preventable, classification of wound according to the CDC, excluded factors of impairing wound healing, frequency of inspecting the wound dressing during the first day after surgery, excluded evidences of infections, Removal time of dressings over closed wound, the first thing done at wound care, the highest nursing actions priority when admitting the patient into the operating room, the immediate nursing action with wound eviscerations, the important nursing intervention prior to administration of pre-anesthetic medication, the reason of skin shaving prior to surgery, the responsibility of the scrub nurse includes, Goals of preoperative skin preparation, most important aspect of hand washing, a nurse is teaching a new nursing assistant about ways to prevent the spread of infection.

Knowledge scoring system:

This tool was adapted from (McFarland, et al., 2020) and modified by the investigator to asses knowledge of nurses regarding prevention surgical site infection for patient after neurosurgery. It consisted of 30 items. The total score for the questionnaire was graded, the right answer was scored as a one grad and the wrong answer will be scored as a zero grade. These scores was summed and converted into a percent score.

- It will be classified into 2 categories:
- Satisfactory knowledge if score ≥75%-
- Unsatisfactory knowledge if score <75%. (McFarland, A., 2020)

Tool II: Observational check list:

This tool was adapted from **(Lepänluoma, et al., 2015)** and was used to assess nurse's practice regarding prevention of surgical site infection for patient after neurosurgery and it will contain more than one check list.

Observational check list included (68 items): It assesses the nurses practice sub items as wound dressing (20), surgical site infection prevention (12), care of drain system (13), removing sutures (9) and wound irrigation (14).

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Scoring system:

Each checklist was assigned a score according to sub-items. The items was evaluated as "done" was taken one score and "not done" was taken zero score. These scores was summed up and was converted into a percentage score.

It was classified into 2 categories:

- Competent if score ≥75%-
- In competent if score <75% -

Content validity of the tools:

The tools validity was done by five expertise in Medical Surgical Nursing Department, Faculty of Nursing, Helwan University. Their opinions were regarding clarity, relevance, comprehensiveness, understanding and applicability of the study tools. Minor modifications were done based on experts judgement and the final form was developed.

Reliability of the tools:

Reliability of tool was applied for the internal consistency of the tools by Cronbach's alpha test and resulted. Reliability of tool I was (r = 0.849) and for tool II was (r = 0.811).

Ethical considerations:

Ethical and administrative committee approvals was obtained at 18-3-2024 with code HUNURSERC 2024 3 4032. Consent was obtained from each participated nurse and confidentiality of data and results was considered. Every nurse had the right to withdraw from the study at any time and without giving any reasons.

Field of work:

The current study was conducted throughout three phases: Assessment phases, implementation phases and evaluation phases.

The investigator was started by introducing himself to each nurse, giving a clear and brief idea about the aim of the study and its expectations. An oral consent was obtained from each nurse prior to the data collection. The investigator was asked each nurse to fill the questionnaire. The investigator was observed the nurses to complete the checklist (twice for each nurse) and the average it was taken. The data collection started and completed within five months from the beginning of April 2024 to August 2024. Two days/ week (Sundays and Mondays). Each nurse took about 20-30 minutes for interviewing and completing interviewing questionnaires including personal data, nurses' knowledge and practice.

Preparatory phase:

It included reviewing of related literature and theoretical knowledge of varies aspects of the study using books, articles, internet, periodical in order to develop and modify the data collection tools.

Pilot study:

A pilot study was carried out on 10% of the expected sample size to test the content, the effectiveness and time consumed to fill in study tools. Based on the results of the pilot study the necessary modifications were done. The sample involved in pilot was excluded from the study .

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Statistical analysis :

All collected data was organized, tabulated, scored and analyzed by presented in figures using the number and percentage distribution, mean and stander deviation using Statistical Package for Social Science (SPSS) version 20. Data were presented using proper statistical tests there were positive correlation or not. The following statistical testes that were used and percentage: Number and percentage: mean and standard deviation (SD) and chi-square(X^2) was used for qualitative data and spearman correlation test.

Statistical significance was considerd at: Highly significant result when P-value < 0.001.Significant result when P-value < 0.05.Non- significant when P-value > 0.05 .

Results:

Table 1: revealed that 40% of the studied nurses were in the 20–<30 age group, with a mean age of 36.41±5.28 years. The majority of participants were female (82%), with males accounting for only 18% of the sample. In terms of marital status, 71% of the nurses were married. Educational qualifications were diverse, with most nurses holding a technical institute diploma (48%), followed by nursing diplomas (35%). A smaller proportion held bachelor's degrees (16%), and only 1% had completed postgraduate education. The distribution of nursing experience years indicates that 45% of the participants had more than 10 years of experience, while 32% had 5–<10 years, and 23% had less than 5 years, with a mean experience of 9.84±7.15 years. Regarding infection control training, 69% of the nurses reported attending relevant training courses. Of those who had attended, the majority (84%) received training within the last two years, while 16% attended over two years ago .

Table 2a: presented the distribution of nurses' knowledge regarding the prevention of surgical site infections (SSI). The results indicate high levels of correct knowledge for several items, such as the definition of SSI (88%), infection classification during hospitalization (87%), and symptoms of SSI (83%). Nurses also demonstrated strong awareness of risk factors such as poor preoperative preparation (91%) and obesity (93%). However, knowledge gaps were observed in certain areas. For example, only 28% of nurses correctly identified the percentage of surgical patients who develop SSIs, and 25% were aware of the mortality rate associated with SSIs. Similarly, only 53% of nurses recognized the use of synthetic sutures as a risk factor, and 60% identified SSIs as the most common healthcare-acquired infection among hospitalized patients .

Table 2b: outlines the distribution of nurses' knowledge regarding the prevention of surgical site infections (SSI) across various detailed aspects. The findings show that nurses demonstrated a high level of correct knowledge in several key areas, including the removal time of dressings over closed wounds (82%), frequency of inspecting wound dressings during the first day after surgery (81%), and the immediate nursing action for wound evisceration (68%).However, the table highlights notable gaps in knowledge. For example, only 46% of nurses correctly identified the estimated number of preventable SSIs and excluded factors impairing wound healing. Similarly, only 51% correctly understood the goals of preoperative skin preparation, and 56% recognized the most important aspect of hand washing. These areas represent potential targets for educational improvement. Despite these gaps, the nurses excelled in other critical areas, such as understanding the reason for skin shaving prior to surgery (83%) and identifying proper actions for teaching new nursing assistants about infection prevention (83%).

Figure1: showed that (68%) of nurses demonstrated satisfactory level of knowledge, while 32% were categorized as having unsatisfactory level of knowledge.

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Table 3: summarized the total practice of nurses in surgical site infection (SSI) prevention for patients after neurosurgery, categorizing their performance as either competent or incompetent. The findings revealed varying levels of competency across different aspects of SSI prevention. Wound care exhibited the highest competency level, with 78% of nurses classified as competent. Similarly, 68% of nurses were competent in removing sutures, and 66% demonstrated competency in general SSI prevention. However, practices such as caring for drainage systems (47% competent) and wound irrigation (51% competent) showed lower levels of adherence, indicating significant gaps in practice. Overall, the total competency level across all practices was 62%, leaving 38% of nurses in the incompetent category.

Figure 2: showed the total competency level across of all practices was 62%, leaving 38% of nurses in the incompetent category.

Table 4: presented the correlation between total knowledge and total practice among the studied nurses. The findings revealed a strong positive correlation between the two variables, with a Pearson correlation coefficient (r) of .849, which is highly significant (p = .000**). This indicates that nurses with higher levels of knowledge are more likely to demonstrate competent practices in their clinical roles.

Table (1): Frequency and Percentage distribution of the studied nurses according to their personal characteristics (n=100).

Personal characteristics	**N**	**%**
Age		
20<30	40	40
30<40	36	36
40<50	22	22
50-60	2	2
Mean & S.D 36.41±5.28		
Gender		
Male	18	18
Female	82	82
Marital status		
Married	71	71
Unmarried	29	29
Nursing experience years		
<5 years	23	23
5 <10 years	32	32
≥ 10 years	45	45
Mean & S.D 9.84±7.15		
Attended training courses related to infection control		
Yes	69	69
No	31	31

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In case of yes since how long (69)		
<2 years	58	84
>2 years	11	16

Table (2a): Frequency and Percentage distribution nurses' knowledge regarding prevention of surgical site infection (n=100).

Items	Correct		Incorrect	
	No	%	No	%
Surgical site infection definition	88	88	12	12
Infection classification of a surgical patient develops a wound infection during hospitalization.	87	87	13	13
Symptoms of surgical site infection	83	83	17	17
Old age is a risk factor of surgical site infection	74	74	26	26
Use of synthetic suture is a risk factor of surgical site infection	53	53	47	47
Prolonged preoperative admission is a risk factor of surgical site infection	81	81	19	19
Failure to use prophylactic antibiotic is a risk factor of surgical site infection	73	73	27	27
Poor preoperative preparation is a risk factor of surgical site infection	91	91	9	9
Obesity is a risk factor of surgical site infection	93	93	7	7
Percentage of surgery patients develop a surgical site infection	28	28	72	72
The most common health care acquired infection among hospitalized patients	60	60	40	40
The mortality rate of surgical site infection	25	25	75	75
Days number after an operative procedure at which a surgical site infection can occur	63	63	37	37

Table (2b): Frequency and Percentage distribution of nurses' knowledge regarding prevention of surgical site infection (n=100).

Items	Correct		Incorrect	
	No	%	No	%
The average additional length of stay in the hospital for patients that develop a surgical site infection	71	71	29	29
The estimated number of surgical site infection that are preventable	46	46	54	54
Classification of wound according to the CDC	67	67	33	33

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Excluded factors of impairing wound healing	46	46	54	54
Frequency of inspecting the wound dressing during the first day after surgery	81	81	19	19
Excluded evidences of infections	46	46	54	54
Removal time of dressings over closed wound	82	82	18	18
The first thing done at wound care	86	86	14	14
The highest nursing actions priority when admitting the patient into the operating room	64	64	36	36
The immediate nursing action with wound eviscerations	68	68	32	32
The important nursing intervention prior to administration of pre-anesthetic medication	66	66	34	34
The reason of skin shaving prior to surgery	83	83	17	17
The responsibility of the scrub nurse includes	77	77	23	23
Goals of preoperative skin preparation	51	51	49	49
Most important aspect of hand washing	56	56	44	44
A nurse is teaching a new nursing assistant about ways to prevent the spread of infection	83	83	17	17

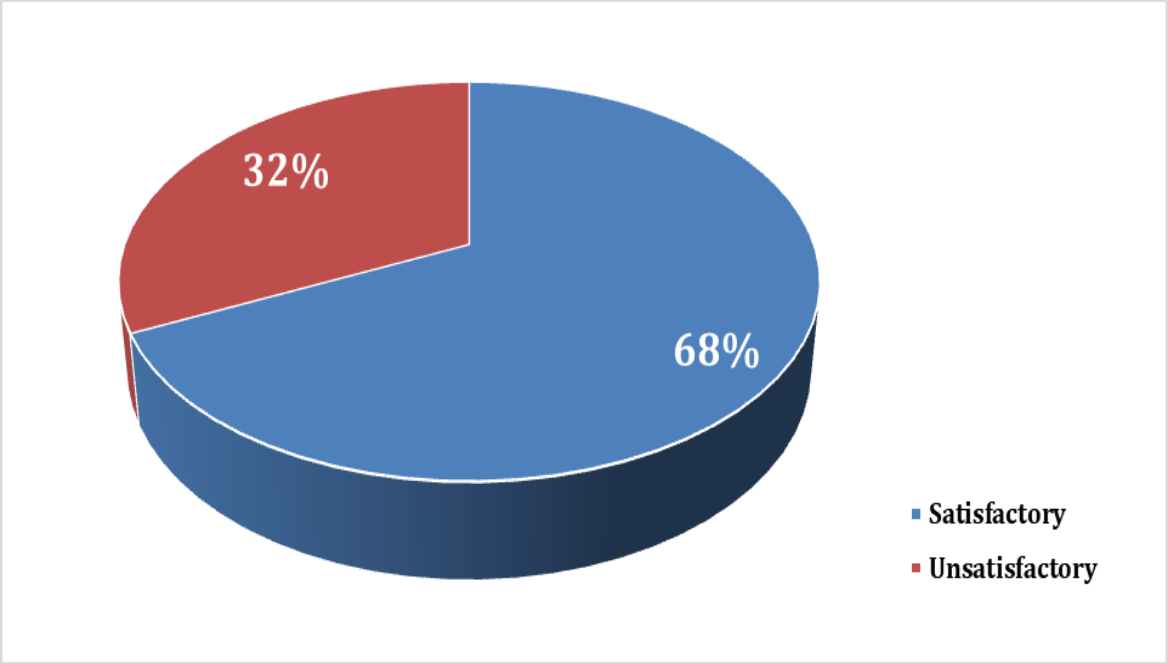

Figure (1): Nurses' total knowledge regarding prevention of surgical site infection (n=100).

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Table (3): Frequency and Percentage distribution of nurses' total practice of surgical site infection prevention for patient after neurosurgery (n=100).

Total accreditation experience	competent		Incompetent	
	No	%	No	%
Wound care	78	78	22	22
surgical site infection prevention	66	66	34	34
Caring of drainage system	47	47	53	53
Removing sutures	68	68	32	32
Wound irrigation	51	51	49	49
Total	62	62	38	38

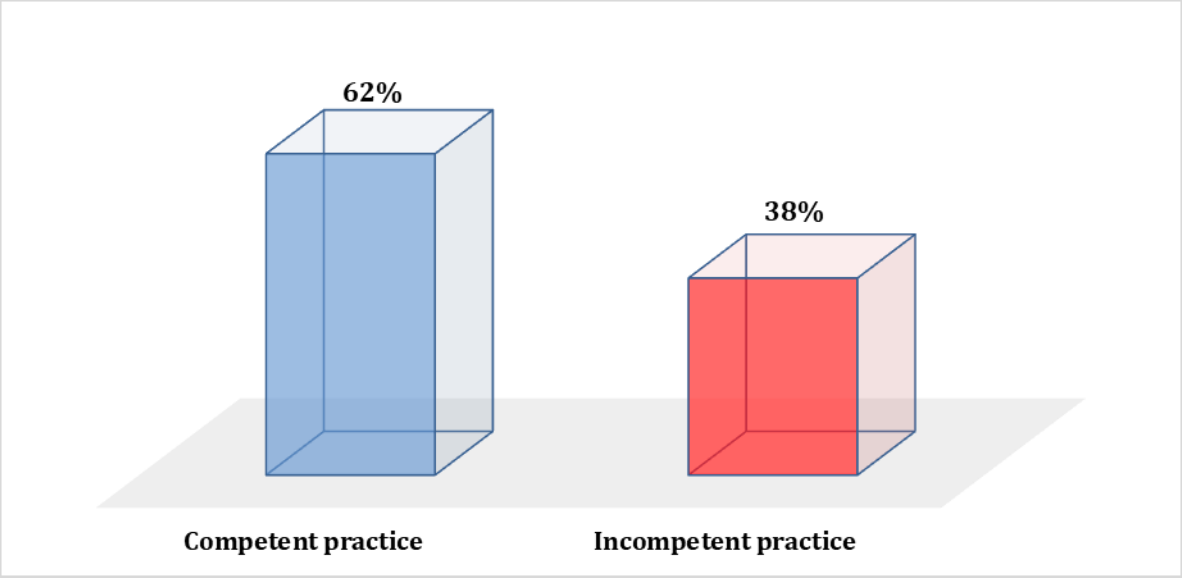

Figure (2): Nurses' total practice of surgical site infection prevention for patient after neurosurgery (n=100).

Table (4): Correlation between nurses knowledge and practice (n=100).

		Total practice
1. Total knowledge	r	.849
	p	000**

(**) Statistically significant at p<0.01. r Pearson correlation

Discussion:

Therefore, the current study aim was to assess nurses' performance regarding prevention of surgical site infection for patients after neurosurgery. 40% of the nurses were in the 20–<30 age group, with a mean age of 36.41±5.28 years. The majority of participants were female (82%), with males accounting for only 18% of the sample. In terms of marital status, 71% of the nurses were married.

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In the same line, **Tesfaye et al., 2022** study showed that, of this total number of respondents, 229 (57%) were females. The mean (±SD) age of study participants was 28.7 (±4.36) years old.

Educational qualifications were diverse, with most nurses holding a technical institute diploma (48%), followed by nursing diplomas (35%). A smaller proportion held bachelor's degrees (16%), and only 1% had completed postgraduate education. The distribution of nursing experience years indicates that 45% of the participants had more than 10 years of experience, while 32% had 5–<10 years, and 23% had less than 5 years, with a mean experience of 9.84±7.15 years. Regarding infection control training, 69% of the nurses reported attending relevant training courses. Of those who had attended, the majority (84%) received training within the last two years, while 16% attended over two years ago.

In difference, **Tesfaye et al., 2022** study showed that Almost half, 197 (49%) of study participants were BSc degree holders and about three fourth of the participants 305 (75.9%) had work experience <5 years. Regarding infection prevention (IP) training only 159 (39.6%) study participants had ever taken IP training

For the distribution of nurses' knowledge regarding the prevention of surgical site infections (SSI), the results indicate high levels of correct knowledge for several items, such as the definition of SSI (88%), infection classification during hospitalization (87%), and symptoms of SSI (83%). Nurses also demonstrated strong awareness of risk factors such as poor preoperative preparation (91%) and obesity (93%).

This was in line with a previous systematic review and meta-analysis by **Habtie et al., 2025** who aimed to assess and synthesize the global evidence on the level of nurses' knowledge and its determinants regarding the prevention of surgical site infections and found that the pooled proportion of nurses with good knowledge of surgical site infection prevention is 62% (95% CI: 50–74%), but we had higher percentage.

In difference with our previous findings, **Jaleta et al**., **2021** study stated that, about two handed eighteen study subject were interviewed the finding shows that 51.8% of nurse were not knowledgeable and around 47.2% of nurses were having poor practice toward SSI prevention.

However, knowledge gaps were observed in certain areas. For example, only 28% of nurses correctly identified the percentage of surgical patients who develop SSIs, and 25% were aware of the mortality rate associated with SSIs. Similarly, only 53% of nurses recognized the use of synthetic sutures as a risk factor, and 60% identified SSIs as the most common healthcare-acquired infection among hospitalized patients.

For the distribution of nurses' knowledge regarding the prevention of surgical site infections (SSI) across various detailed aspects, the findings show that nurses demonstrated a high level of correct knowledge in several key areas, including the removal time of dressings over closed wounds (82%), frequency of inspecting wound dressings during the first day after surgery (81%), and the immediate nursing action for wound evisceration (68%).

However, there were notable gaps in knowledge. For example, only 46% of nurses correctly identified the estimated number of preventable SSIs and excluded factors impairing wound healing. Similarly, only 51% correctly understood the goals of preoperative skin preparation, and 56% recognized the most important aspect of hand washing. These areas represent potential targets for educational improvement.

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Regarding nurses' total knowledge of surgical site infection, the present study showed that more than two third of studied nurses had total satisfactory knowledge **(Figure 1).** These result was in consistent with **Gizaw, et al., (2022)** in a study entitled "Knowledge, practice, and associated factors towards postoperative wound care among nurses working in public hospitals in Ethiopia: A multicenter cross-sectional study in low resource setting area", Ethiopia (n=465) who found that 44.3% of nurses had good knowledge.

The present study showed that the 68% of nurses demonstrated satisfactory knowledge, while 32% were categorized as having unsatisfactory knowledge **(Figure 1).** These results were in consistent with **Ahmed, et al., (2024)** in a study entitled who reported that 40.7% of the nurses had poor knowledge level, 10.4 % had average knowledge, 22 % had good knowledge and 26.74% of nurses had excellent knowledge regarding surgical site infection. From the investigator point of view, this is might because more than two third of nurses attended training course related infection control,

For detailed breakdown of the nurses' adherence to proper wound dressing practices, highlighting areas of compliance and non-compliance. Certain practices, such as removing the outer wound dressing immediately prior to the procedure and disposing of it in a biohazard bag (100%), pouring antiseptic solution in the dressing set (100%), and cleaning the wound with sterile forceps and cotton swabs (100%), were universally performed. These results indicate strong adherence to critical infection control measures. From the investigator point of view, this may return to that less than half nurses more than 10 years of experience and about one third has 5-10 years of experience.

However, other practices showed significant variability. For example, only 53% of nurses wore protective equipment such as gowns, masks, and goggles when splashing was anticipated. Additionally, only 62% disinfected the trolley with 70% alcohol, and 64% practiced proper hand hygiene before and after the procedure.

This was confirmed by **Lin et al., 2019** who identified the facilitators of and barriers to nurses' adherence to evidence-based wound care clinical practice guidelines in preventing SSIs and concluded that there is a need to develop interventions to improve nurses' adherence to recommended care clinical practice guidelines including hand hygiene.

Regarding nurses' total practice of surgical site infection, the present study showed the total competency level across all practices was 62%, leaving 38% of nurses in the incompetent category **(Figure 2)**. The result was in consistent with **Muhammad, et al., (2025)** The current study revealed that the majority of the nurses, 65%, had an average level of practice scores, 14% had good practice scores, 14% had poor practice scores, and only 7% of the studied participants had excellent practice scores regarding surgical site infection.

For the correlation between total knowledge and total practice among the studied nurses, the findings reveal a strong positive correlation between the two variables, with a Pearson correlation coefficient (r) of .849, which is highly significant. This indicates that nurses with higher levels of knowledge are more likely to demonstrate competent practices in their clinical roles.

In agreement with our findings **Vincent, C. C. N. (2022)** noted that there is positive and moderate correlation between knowledge and attitude towards SSIs prevention as well as between knowledge and practice. High correlation was however found for attitude and practice of SSIs prevention.

In coherence with us, **Magni et al., 2024** found that the annual incidence rate of SSI was 6.21%, 5.01%, 3.89%, 3.06%, 2.38% and 2.28%, respectively, showing a significant

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decreasing trend. The results provide evidence of a significant decreasing trend in the SSI rate following the infection prevention program, demonstrating the role of multimodal approach in controlling SSI.

Also, **Spine Deformity. (2023)** supported our study data and stated that within 4 months of preoperative SSI prevention protocol for pediatric neurosurgical patients was implemented to assess its effect on SSI rate, overall protocol adherence increased from 51.3% to a sustained 85.7%. SSI rates decreased from 2.9 per 100 procedures pre-intervention to 0.62 infections post-intervention. An approximate 79% reduction in SSI risk was identified.

Conclusion

Based on the results of present study and research question, the following can be concluded:

More than two third of studied nurses had satisfactory total knowledge level regarding prevention of surgical site infection for patient after neurosurgery , while more than three fifth of them had total competency level across all practices level regarding prevention of surgical site infection for patient after neurosurgery. Also, there was strong positive correlation between total knowledge and total practice among studied nurses, with a Pearson correlation coefficient (r) of .849, which is highly significant (p = .000**).

Recommendations:

Based upon the findings of the present study, the following has been recommended:

1- Conducting training program for nurses to enhance their awareness nurses to help them to improve their performance regarding prevention of surgical site infection for patient after neurosurgery.

2-Establish and disseminate boosters and booklet about prevention of surgical site infection for patient after neurosurgery.

3-Establish electronic web regarding prevention of surgical site infection for patient after neurosurgery.

For future research:

4-Further studies needed to be focusing on improving quality of life among performance regarding prevention of surgical site infection for patient after neurosurgery

5-Further programs with continues follow up for nurses to help them to improve their performance regarding postoperative wound care through applying infection control measures and monitoring periodically the nurses' performance

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