

Assessment of Nurses' knowledge and Performance Regarding Prevention of Open Heart Surgery Site Infection

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1. ABSTRACT

Open heart Surgical Site Infection (SSI) is a life-threatening complication that occurs after cardiac surgery, it is associated with severe outcomes including exacerbation all of the following: hospitalization, healthcare costs, morbidity, and mortality. The present study aimed to assess nurses' knowledge, and performance regarding prevention of open heart surgery site infection. This conducted through a cross-sectional study design, on 77 nurses enrolled conveniently from Open Heart Surgery Unit, Mansoura University Hospitals, Egypt. Data was collected by using nurses' knowledge assessment self-administrated questionnaire and nurses' performance observational checklist. The main findings illustrated that 45.5% of nurses had poor total score level of knowledge (< 60.00 – 69.99), and 41.6% of them had expert total score level of performance (75 - < 85%). The researcher concludes that less than half of nurses have poor total knowledge score, and more than three-fourths of them have total expert, and proficient performance scores levels regarding the prevention of open-heart SSI. Accordingly, the following are recommended: continuous on job education programs should be provided for all nurses to enhance their knowledge and performance about prevention of open heart SSI, as well, further research are needed to explore factors that contribute to nurses' adherence to preventive measures of open-heart SSI.

Keywords. knowledge, Performance, Open Heart Surgery, Surgical Site Infection

2. Introduction:

Healthcare-associated infections (HAIs) are a significant public health concern, affecting millions annually (Jaleta, Adimasu, & Amentie, 2021). Since, it is consider one of the top five killers in the USA (Haque, Sartelli, McKimm & Bakar, 2018). Cost of HAIs alone in USA range from US\$28 to US\$45 billion annually, although with this level of spending, 90,000 lost lives occur annually. Prevalence of HAIs in the USA, is 3.2% of all hospitalized patients, compared to 6.5% in the European Union/European Economic (EU/EEA), this probably much higher worldwide (Suetens et al., 2018).

HAIs exacerbate all of the following: hospitalization, healthcare costs, morbidity, and mortality. Hence, infection prevention, and control are vital for a well-functioning health system (Salem, 2019). Therefore, there is a need for further studies and practices modifications to achieve hospitals safety and infection prevention (Haque, Sartelli, McKimm & Bakar, 2018).

Surgical site infection (SSI) constitutes up to 20% of HAIs, as SSIs occur in at least

5% of patients carrying out surgical procedures (Boga, 2019). According to CDC, (2020), SSIs are defined as "the infections that occur within the first 30 days after a surgical operation if no implant is placed or within a year after a surgical operation if an implant is placed".

Postoperative superficial and deep SSIs incidence in cardiac surgery range from 1.3% to 12.8% this depends on risk factors of SSIs. Classically, SSIs followed by cardiac surgery present with localized cellulitis (erythema, warmth, and tenderness), purulent discharge, sternal instability, chest pain, and systemic upset with deep infections (Nabi, Akhter & Tabassum, 2020).

Accordingly, open heart SSIs lead to serious complications including: morbidity, mortality, and additional costs, which carry over burden on healthcare systems and payers all over the world (Allegranzi et al., 2016; Schimmer et al., 2017). This illustrates importance of compliance to preventive measures, intensity of surveillance, and definition used for mediastinitis (Schimmer et al., 2017).

It is vital to prevent infection while caring of patients undergoing open-heart surgery, which input in the privileges of improve patients' outcomes and can save millions of dollars (Horton, Alvarez & McNutt, 2019). Since patients care, and first-hand contact with the nurse. Nurses should be aware of SSIs: classifications, risk factors and populations at risk, signs, and symptoms, antibiotic prophylactic use, preoperative skin preparations, postoperative surgical field care, infection control standards, and SSIs prevention strategies. Nurses should also defend their patients in any case (Qasem & Hweidi, 2017).

According to a study by Brisibe, Ordinioha and Gbeneolol, (2014), most nurses require knowledge, and the majority of them improperly practice in accordance with evidence-based guidelines and recommendations, in relation to prevention of SSIs. As complexity and numerous precautions have required to prevent open heart SSI; before, during, and after surgery. In addition, absence of standardized in implementation of these measures overall the world (Gök, Kabu & Özbayir, 2016). Therefore it is pivotal to equip nurses with correct knowledge and guidance related infection control policy, hand hygiene, and antibiotic resistance; as they continuously care for risky patients (Mamhidir, Lindberg, Larsson, Fla"ckman, & Engstro"m, 2011).

Furthermore, developing patients care standards, and innovating changes are a particular responsibility for nurses. So, they should understand that HAIs can be prevented, and acquire updated knowledge on widely established universal preventative measures concerning the prevention and control of infections (Özkal et al., 2014).

Aim of the Study

This study aimed to assess nurses' knowledge and performance regarding prevention of open heart surgery's site infection.

Research Questions

1. What are levels of nurses' knowledge regarding prevention of surgical site

infection in open heart surgery?

2. What are levels of nurses' performance regarding prevention of surgical site infection in open heart surgery?

Method

Study Design

A cross-sectional study design was used to conduct this study.

Setting

The study conducted at the Open Heart Surgery Unit affiliated with Mansoura University Hospital (ICU –Ward).

Participants and Sampling

Convenience sampling technique was used to recruit all on job nurses working in the previous mentioned setting with at least one year of experience were enrolled to assess their knowledge and performance in relation to prevention of open heart SSIs. They were recruited conveniently.

Ethical Considerations and administrative process.

The researcher obtained approval from Research Ethics Committee, Faculty of Nursing, Mansoura University. As well, the researcher obtained oral informed consent from the participants, they assured that their participation in the study was voluntary, and the collected data would be treated confidentially and only used to improve health services. Participants informed that they had the right to ask any question related to the study and withdraw at any time from the study without any responsibility, and without giving any reason. An official letter from the Faculty of Nursing was submitted to director of Cardiovascular Surgery Center, affiliated to Mansoura University Hospital to obtain their approval for conducting the study. The researcher informed the director about the aim of the study, and its process in order to gain their cooperation, and support during data collection.

Data Collection

After reviewing the relevant literatures the researcher developed three tools as the following:

Tool I: Nurses' socio-demographic and occupational characteristics self-administrated structured questionnaire. this questionnaire was used to collect socio-demographic and occupational characteristics of the nurses including age, gender, residence, marital status, education level, working experience, and in-service training.

Tool II: Nurses' knowledge assessment self-administrated structured questionnaire. This questionnaire was developed by the researcher based on Sickder et al., (2014), to assess nurses' knowledge levels regarding the prevention of open heart SSIs. The questionnaire covered the pre-operative period (including hand hygiene and skin preparation, shaving, showering/bathing, screening and decolonization for *Staphylococcus aureus*, controlling underlying medical conditions, maintaining nutritional status, and antibiotic prophylaxis) and post-operative period (surgical wound care with aseptic precautions, wound assessment, monitoring of SSI, and nutritional support).

Nurses' knowledge scoring system. One mark was given for the correct response, and zero mark for the incorrect one. The score will transform into a percentage. The researcher divided the transformed scores into three levels according to McDonald, (2002), and modified them as follows: poor level of knowledge was (< 60.00 – 69.99 %), fair level of knowledge was (70.00 – 79.99%) while the good level of knowledge was (80.00 – 100.00 %).

Tool III: Nurses' performance observational checklist. The researcher developed the checklist according to Sickder et al., (2014), to observe nurses' performance regarding prevention of SSI of open heart surgery pre and post -operative periods. It included hand washing and skin preparation, shaving, showering, oxygen supplementation, antibiotic prophylaxis, surgical wound care with aseptic precaution, chest tube care,

arterial line care, central line care, wound care and monitoring of SSI.

Nurses' performance scoring system. One mark awarded for each proper step, and zero mark for improper and not done step. According to the researcher's cut of point, the performance levels consisted of four categories as the following: improper (< 60.00), master (60.00– < 75.00), expert (75.00– < 85.00), and proficient (85.00 or more).

Validity and reliability of the tools.

Tools of data collection were tested for content validity by a panel of five experts from Open Heart Surgery Department, Faculty of Medicine, Mansoura University, and Critical Care, and Emergency Nursing Department, and Community Nursing Department; Faculty of Nursing, Mansoura University who reviewed the English and Arabic tools for clarity, relevance, and applicability. Accordingly, the researcher made the modifications. Internal consistency, and reliability of knowledge assessment self-administrated structured questionnaire assessed via Cronbach's Alpha which revealed that $r=0.81$.

Pilot study. The researcher carried out it on 10% (8 nurses) of the study sample who was included in the study sample to test the clarity, objectivity, and applicability of study's tools.

The duration of data collection lasted approximately six months from June to December 2021; six days per week, covering two work shifts. The researcher introduced herself to nurses and gave them a brief orientation about the aim of the study to gain their cooperation.

The researcher distributed the self-administrated questionnaires (Tools I, and II) to nurses at their units and asked them to fill out the assessment questionnaire. The researcher collected it immediately after completion, each nurse required 15-20 minutes to answer questions. The researcher observed nurses' performance regarding the prevention of SSIs of open heart surgery using tool III.

Statistical Analysis

After data collection, it was revised, coded, processed, and then analyzed using the statistical software IBM SPSS version 21. The quantitative data were presented in mean, and standard deviation (SD), while the qualitative data was presented as number (n) and, percent (%). Pearson correlation was done between variables. The difference was considered significant at P 0.05. Regarding the scoring system, the items' discrete scores for each scale were summed together as the sum of scores for each dimension and, the total score was calculated by summing the scores given for its responses. All scores were transformed into score % as follow: $\text{Score \%} = (\text{the observed score} / \text{the maximum score}) \times 100$.

Results

Table 1 shows that 74% and 59.7 % of nurses were females, and aged from 25 to 35 years with a mean age of 27.26 (6.02), respectively. Finally, 48.1% of nurses; had bachelor's degrees in nursing.

Table 1 Nurses' socio-demographic characteristics (n = 77)

| Items | N | (%) |
|-------------------------------|----|------|
| Age | | |
| 25 – 35 Years | 46 | 59.7 |
| Less than 25 Years | 24 | 31.2 |
| More than 35 Years | 7 | 9.1 |
| Mean (SD) 4.88 (5.69) Years | | |
| Gender | | |
| Woman | 57 | 74.0 |
| Man | 20 | 26.0 |
| Residence | | |
| Urban | 39 | 50.6 |
| Rural | 38 | 49.4 |
| Qualification | | |
| BSc in nursing | 37 | 48.1 |
| Nursing technical institute | 27 | 35.1 |
| Postgraduate studies (Master) | 7 | 9.1 |
| Nursing Diploma | 6 | 7.8 |

Table 2 Nurses' occupational characteristics (n = 77)

| Variables | N | (%) |
|---|----|------|
| Years of work experience | | |
| Less than 5 years | 50 | 64.9 |
| 5 – 10 years | 18 | 23.4 |
| More than 10 years | 9 | 11.7 |
| M(SD) 5.91 (5.88) Years | | |
| Years of practical experience in the cardiac ICU | | |
| Less than 5 years | 50 | 64.9 |
| 5 – 10 years | 18 | 23.4 |

Table 2 reveals that 48.1%, 64.9%, 72.7%, and 26.0% of nurses had less than five total years of experience in general with a mean of 5.91 (5.88) years, less than five years of practical experience in the cardiac intensive care with mean of 4.88 (5.69) years, and attended less than three times training courses regarding prevention of open heart surgery's site infection, respectively.

Table 3 illustrates that 45.5% of nurses had a total poor knowledge level with percentages ranging from 10.4% to 97.4%, the lowest one related to their knowledge related to pre-operative shower, while the highest percentage for pre-operative hair removal.

Table 4 declares that 41.6% of the studied nurses had a total expert performance score level with percentages ranging from non to 39.0%, the lowest one related to their performance related to shaving, skin preparation, and showering, while the highest percentage for surgical dressing.

Assessment of Nurses' knowledge and Performance

| | | |
|---|----|------|
| More than 10 years | 9 | 11.7 |
| M(SD) 4.88 (5.69) Years | | |
| Training courses attendance regarding prevention of infection at the site of open-heart surgery | | |
| Less than 3courses | 20 | 26.0 |
| 3 courses and more | 10 | 13.0 |

Table 3 Nurses' scores levels of knowledge about prevention of open heart surgery's site infection (n = 77)

| Knowledge items | Score levels | | | | | |
|---|--------------|------|------|------|------|------|
| | Poor | | Fair | | Good | |
| | N | % | N | % | N | % |
| General knowledge about infection prevention and control (15 marks) | 32 | 41.6 | 5 | 6.5 | 40 | 51.9 |
| Hand washing (23 marks) | 30 | 39.0 | 14 | 18.2 | 33 | 42.9 |
| Personal protective equipment (8 marks) | 40 | 51.9 | 17 | 22.1 | 20 | 26.0 |
| Health aspects for open heart surgery patients | | | | | | |
| Nutritional status (6 marks) | 47 | 61.0 | 0 | 0.0 | 30 | 39.0 |
| Control of blood glucose level before surgery and smoking (4 marks) | 17 | 22.1 | 39 | 50.6 | 21 | 27.3 |
| Nose colonization removal (3 marks) | 61 | 79.2 | 0 | 0.0 | 16 | 20.8 |
| Teeth care (5 marks) | 46 | 59.7 | 0 | 0.0 | 31 | 40.3 |
| Antibiotics and immunosuppressive drugs (3 marks) | 63 | 81.8 | 0 | 0.0 | 14 | 18.2 |
| Pre-operative | | | | | | |
| Skin preparation (6 marks) | 50 | 64.9 | 0 | 0.0 | 27 | 35.1 |
| Hair removal (3 marks) | 75 | 97.4 | 0 | 0.0 | 2 | 2.6 |
| Shower (4 marks) | 8 | 10.4 | 52 | 67.5 | 17 | 22.1 |
| Post-operative | | | | | | |
| Wounds dressing and monitor signs of infection (21 mark) | 23 | 29.9 | 4 | 5.2 | 50 | 64.9 |
| Total score (101 marks) | 35 | 45.5 | 27 | 35.1 | 15 | 19.5 |

<70% (Poor). 70% - <80% (Fair). 80% - < (Good).

Table 4 Nurses' scores levels of performance about prevention of open heart surgery site infection (n = 77)

| Practice items | Score levels | | | | | | | |
|--|--------------|------|--------|------|--------|------|------------|------|
| | Improper | | Master | | Expert | | Proficient | |
| | N | % | N | % | N | % | N | % |
| Hand washing (11 marks) | 19 | 24.7 | 9 | 11.7 | 7 | 9.1 | 42 | 54.5 |
| Shaving, skin preparation and showering (7 marks) | 31 | 40.3 | 43 | 55.8 | 0 | 0.0 | 3 | 3.9 |
| Antibiotic prophylaxis (14 marks) | 5 | 6.5 | 17 | 22.1 | 9 | 11.7 | 46 | 59.7 |
| Monitoring sign and symptoms of infection (18 marks) | 3 | 3.9 | 21 | 27.3 | 18 | 23.4 | 35 | 45.5 |
| Surgical dressing (60 marks) | 1 | 1.3 | 10 | 13.0 | 30 | 39.0 | 36 | 46.8 |
| Total score (110 marks) | 0 | 0.0 | 17 | 22.1 | 32 | 41.6 | 28 | 36.4 |

< 60% (Improper). 60 - < 75% (Master). 75 - < 85% (Expert). 85 and more (Proficient).

Discussion

All over the world, SSI is a prevailed healthcare-associated infection that is a burden on both patients and healthcare systems (Monahan et al., 2020). Post cardiac surgery sternal wound infection can be a serious complication (Locke, et al., 2022). In most

studies reported incidence of sternal infections ranges from 0.9% to 20%, and the incidence of mediastinitis is 1% to 2% (Negargar, 2022).

Increase morbidity, with a prolonged hospitalization and an increased cost of care; all are consequence to deep infections (Yu et al., 2022). This supported by a study by

Kaspersen et al., (2021) revealed that mortality rate for patients with deep sternal infections ranges from 9.8% to 14%. Furthermore, cost for patients with sternal wound complications has been estimated to be 2.8 times that for patients with uncomplicated postoperative courses (El Ashkar & Khallaf, 2019).

Risk factors of SSI are sophisticated, and their prevention requires integration of a range of measures, before, during, and after surgery, these measures, are called a “bundle” (Zucco, Lavano, Nobile, Papadopoli & Bianco, 2019). Bundles to prevent cardiac surgery SSI involve the use of prophylactic antibiotics during the immediate pre-and postoperative period, blood glucose level control during the first and second postoperative period, temperature and oxygenation control, decolonization of patients with intra-nasal mupirocin, and preoperative chlorhexidine bath (Andrade et al., 2019).

Effective prevention of SSIs require redesigning systems to eliminate hinders and maximize prevent strategies and guidelines based on evidence-based processes of care; so, all nurses will be comply with those guidelines which are essential to decrease SSI rate (Sadaf, Shafqat & Hussain, 2018). Since nurse’s role in health care system is pivotal, therefor, their updated knowledge and performance are a vital part of patients care, and prevent, and control these infections (Patil, Raval & Chavan, 2018).

The current study indicates that; less than half of nurses have poor total score level of knowledge regarding the prevention of open-heart surgery site infection. This result agrees with Zucco, Lavano, Nobile, Papadopoli & Bianco, (2019), study which illustrated that the level of knowledge among surgical ward nurses was poor.

In the same line, a study by Sadaf, Shafqat & Hussain, (2018) showed that nurses reported a low level of knowledge, and Qasem & Hweidi, (2017) who studied nurses’ knowledge of preventing SSI in acute care settings, showed that they had a low level of knowledge regarding evidence-based guidelines for the prevention of SSIs.

Furthermore, Famakinwa, Bello, Oyeniran, Okhiah & Nwadike, (2014), who studied nurses' knowledge and practice of postoperative wound infection prevention in the surgical unit, teaching hospital, Nigeria, mentioned that more than two-thirds of them had poor knowledge.

In addition, Ayed, (2015), who worked on a study of the knowledge and practice of nursing staff regarding infection control measures in Palestinian hospitals, demonstrated that; almost half of the respondents had fair knowledge.

On the other hand, this finding disagrees with Gezie, (2021), study of health care workers' knowledge, attitude, and practice towards hospital-acquired infection prevention at Dessie referral hospital, Northeast Ethiopia, which declared that they had good knowledge. As well, Desta, et al., (2018) who studied knowledge, practice, and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia, conducted in Bahirdar city, indicated that they had good knowledge.

Considering the findings of the current study, more than three-fourths of nurses have expert and proficient total scores levels of performance in the prevention of open-heart SSIs. These results agree with Patil, Raval & Chavan, (2018), study of knowledge and practices of health care professionals to prevent SSI in a tertiary health care Centre, which illustrated that the majority of them had a higher level of practice.

In the same line, a study by Allah-Bakhshian, Moghaddasian, Zamanzadeh, Parvan & Allah-Bakhshian, (2010) studied the knowledge, attitude, and practice of ICU nurses about nosocomial infection control in teaching hospitals in Tabriz revealed that; almost all participants had an average practice. Also, these findings matched with Joshi, (2014), study to assess staff nurses' knowledge and practice regarding the prevention of SSI in a hospital in Udaipur city, which demonstrates that; they had a high level of practice.

Additionally, these findings agree with Teshager, Engeda & Worku, (2015) study of

nurses' knowledge, practice, and associated factors towards prevention of SSI in Amhara Regional State referral hospitals, Northwest Ethiopia, illustrated that their practice activities were good.

These results in the opposite direction with Sadaf., Shafqat, Hussain, (2018), who concluded that three-quarters of nurses had a low level of practice about SSI, and recommended that the hospital administrators need to conduct education and training programs to enhance knowledge about SSI prevention to improve the quality of nursing care in this area.

Also, these findings disagree with Mohsen, Riad & Badawy, (2020) who study compliance and barriers facing nurses with SSI prevention guidelines, and declared that three-quarters of them had a low level of practice. As well, Sadaf, Shafqat & Hussain, (2018) revealed that the practice of the nurses regarding SSI was not satisfactory.

Additionally, in the opposite line Gezie, (2021), who assessed health care workers' knowledge, attitude and practice towards HAI prevention in Dessie referral hospital, illustrated that; more than two-thirds of them had poor practice.

The researcher's argument illustrates that less than half, and less than two-thirds of nurses in the current study have bachelor's degrees in nursing, and are relatively newly graduated, respectively, as well, more than one-third of nurses have got training courses regarding the prevention of open-heart SSI, this reflects the need for continuous training courses about infection prevention, and control to facilitate adherence.

Conclusion

The researcher concludes that less than half of nurses have poor total knowledge score, and more than three-fourths of them have total expert, and proficient performance scores levels regarding the prevention of open-heart SSI.

Recommendations

- Continuous on job education programs should be provided for all nurses to enhance their knowledge and

performance about prevention of open heart SSI .

- Further researchs are needed to explore factors that contribute to nurses' adherence to preventive measures of open-heart SSI.

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