

The Impact of Surgical Safety Guidelines on physicians' and Nurses' Performance and Complications Following Surgery in Saudi Arabia 2024

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ABSTRACT

Background: Surgical care is an integral part of healthcare throughout the world. A significant obstacle facing the health care sector has been surgical safety. Significant advancements have been made in determining the root causes of errors and comprehending the connection between patient outcomes and safety.

The study aims: To examine the impact of the implementation of surgical safety guidelines on the performance of physicians and nurses, as well as the incidence of postoperative complications in Saudi Arabia (KSA).

Method: A quasi-experimental research design was conducted at the operating room and general surgery department at hospitals in Makkah, KSA. Sample: A convenient sample of 72 of healthcare providers (HCPs) (physicians and nurses) and 100 patients at the general surgery department. Tools: Four tools were used: I: self-administered questionnaire it included: demographic characteristics of the physicians and nurses and physicians' and nurses' knowledge assessment questionnaire, II: physicians' and Nurses' safety practices observational checklist. III: Safety attitude questionnaire, IV: Post-operative Complications Questionnaire: It included demographic characteristics of the patients and post-operative complications.

Results: There were high statistically significant differences between physicians' and Nurses' mean scores of knowledge post implementation of surgical safety guidelines. All of anesthesia performed surgical safety practices, there were highly statistically significant differences between nurses' attitudes regarding reporting any safety concerns and working with physicians as a team. As well; there was highly statistically significant reduction of some post-operative complications post implementation of surgical safety guidelines.

Conclusion: HCPs' implementation of surgical safety guidelines had a positive effect on their performance and on reduction of post-operative complications.

Recommendations: Surgical safety guidelines should be implemented as part of daily surgical routine and encourages its use to all surgical operations.

Keywords: Performance, Post-operative complications and surgical safety guidelines

INTRODUCTION

The operating room (OR) is a high-tech hospital environment where anesthetic, surgical, diagnostic, and therapeutic procedures are carried out using cutting-edge technologies. Patient safety is a top priority in this high-risk medical environment. Compared to other workplace types, operating rooms have developed into increasingly complex, multidisciplinary work settings. The health of the operating room staff, patient safety,

and surgical results can all be adversely affected by long work hours, a stressful work environment, and the need for teamwork⁽¹⁻³⁾.

Surgery is sometimes regarded as the sole treatment available to decrease mortality rates from common illnesses and lessen impairments. An estimated 13% of all management interventions are surgical procedures, which are performed on millions of patients annually. However, with a reported crude death rate of 0.5–5% following major surgery and complications following inpatient procedures occurring in as many as surgical procedures account for 25% of all adverse events in hospitalized patients, with at least half of these events being preventable⁽⁴⁾.

According to the World Health Organization (WHO), patient safety is the absence of avoidable damage to a patient while they are receiving medical treatment. Patient safety encompasses both the absence of patient damage and preventative measures, as well as the application of medical procedures that eradicate known causes of frequent mistakes. Since 50% of surgery-related errors and consequences may be avoided, it is regarded as the cornerstone of high-quality patient care and a top priority to offer safe patient care in the operating room. Surgical procedures account for 25% of all adverse events in hospitalized patients, with at least half of these events being preventable^(5, 6).

One of the biggest challenges facing nurses over the last 20 years has been surgical patient safety. Significant advancements have been made in determining the root causes of errors and comprehending the connection between patient outcomes and safety. Human error occurs more frequently in operating rooms than in other hospital departments for a variety of reasons, including complex surgery, multiple team compositions from daily operations, high-alert medications, work pressure, high patient turnover, and the need for quick interventions in emergency surgery situations. About half of all adverse events in hospitalized patients which affect 25% of patients are related to surgical care, and at least half of these events are thought to be preventable⁽⁷⁾.

Surgical site errors, improper handling of surgical specimens, drug-related events like allergic reactions or skin rashes, poor blood loss management, environmental risks, surgical items being left inside the patient's body, infections linked to medical care, and anesthesia-related complications like cardiac arrhythmias are some of the risks to surgical safety that can arise from poor procedures or poor communication among surgical team members. By encouraging efficient communication and creating common safety models, the World Health Organization's (WHO) safe surgical checklist is utilized globally to increase patient safety during surgery⁽⁸⁾.

It's estimated that 134 million adverse events occur in hospitals each year which result in over 2.6 million people death in low- and middle-income nations⁽⁹⁾. In KSA, study conducted by Saggafet al., (2023)⁽¹⁰⁾ revealed that post-surgical complications occurred in 70.2% of the open surgeries and 27.4% of the laparoscopic procedures. In numerous settings involving gastrointestinal surgeries, there is evidence that the minimal surgical trauma associated with the laparoscopic technique led to a noticeably shorter duration of hospital stays, lower level of postoperative discomfort and a faster recovery to carry out daily activities⁽¹¹⁻¹³⁾.

Operating room healthcare providers must possess the skills and knowledge necessary to meet national patient safety goals. This entails being responsible for preserving the equipment' sterility and taking preventative measures to lower the risk of surgical site infections and problems following surgery. Additionally, it calls for the capacity to manage biological specimens, identify the requirements of the surgical team, and create care plans. Identifying patient safety risks, such as blood loss and airway obstruction or aspiration; accurately measuring surgical supplies; managing environmental dangers; and improving interpersonal communication are other crucial concerns^(6, 14).

Therefore, this study aims to evaluate the effect of healthcare providers' implementation of surgical safety guidelines on their performance and post-operative complications through: Assessing healthcare providers' performance regarding surgical safety guidelines. The study assesses the impact of healthcare providers' adherence to surgical safety guidelines on their performance and the occurrence of post-operative complications.

METHODS

A quasi-experimental research design (pre and posttest) was used to fulfill the aim of this study. The effect of an intervention without randomization is estimated using a quasi-experimental study methodology. Both before and after the sample is exposed to a stimulant, the pre/post-test research design includes evaluating key results. A researcher can value the change in desired outcomes to be exposed to the stimulant by designing an experiment in this direction. This study was conducted at the operating room and general surgery department at hospitals in Makkah, KSA. A convenient sample of 72 HPCs (physician and nurses); a purposive sample of 100 adult patients who were undergoing gastrointestinal, vascular, or orthopedic operations at the general surgery department.

The sample size was calculated by adjusting the power of the test to 80%, and the confidence interval to 95% with a margin of error accepted adjusted to 5% using the following equation: Type I error (α) = 0.05% Type II error (B) = 0.20% with power of test 0.80%. Based on this equation, the sample size is 100 patients participated

in this study.

$$n = \frac{N \times p(1-p)}{[N-1 \times (d^2 \div z^2)] + p(1-p)}$$

Tools of data collection: Four tools were used to collect the data:

Tool I: Self-administered questionnaire: It was developed by the researchers based on literature review⁽¹⁶⁻¹⁸⁾. It composed of two parts: Part I: Demographic characteristics of the HCPs. This part included age, gender, qualification, years of experience at OR, attendance of training programs related to surgical patients safety. Part II: HCP's knowledge assessment questionnaire: It developed by the researchers in Arabic language after reviewing of related literature to assess the HCP's knowledge regarding surgical patients' safety. It included (definition of surgery, phases of surgery, and threats of patients' safety at operating room and HCP role to maintain patients' safety before and during operation and during anesthesia). Scoring system of HCP's knowledge assessment questionnaire: Each correct answer was given score (one) and incorrect answer was given score (zero) and mean score was calculated for each item.

Tool II: Nurses' safety practices observational checklist: It was adapted from WHO surgical safety checklist and was modified by the researchers to evaluate practical levels of HCPs regarding surgical patients' safety. Scoring system of HCPs' safety practices observational checklist: Each done step had score (one) and not done step had score (zero) and mean score was calculated for each item.

Tool III: Safety attitude questionnaire (SAQ): This questionnaire was adapted from Sexton et al, (2006)⁽¹⁹⁾ and included six statements to assess HCPs' attitude regarding surgical safety at the operating rooms. It was translated into Arabic. The researchers modified the wording of some items for use in the operating rooms to assess HCPs' attitude about surgical safety at the OR. Scoring system of safety attitude questionnaire: All responses were recorded on a five point likert scale: (1 Disagree strongly = 0%, 2 disagree = 25%, 3 neutral = 50%, 4 agree = 75% and 5 agree strongly = 100%). Two negatively worded statements were reverse scored to calculate summary statistics.

Tool IV: Post-operative complications questionnaire: It was developed by the researchers in to Arabic language after massive literature review⁽²⁰⁻²²⁾ to assess patients' complications within 30 days after operation. It consisted of two parts: Part I: Demographic and medical characteristics of the patients: It included age, gender, and history of chronic disease, length of hospital stay, type of anesthesia used, and type of surgical procedure performed. Part II: Post-operative complications: It was used to assess patients' complications within 30 days after operation and contained main complications that the patient may experience after surgery as surgical site infections, respiratory pneumonia, deep venous thrombosis/ pulmonary embolism, ICU and ventilator use \geq 48 hours, bleeding that needed more than 4 units of blood transfusion, unplanned return to the OR, death and if the patient has more than or equal to 2 complications.

Scoring system of post-operative complications: Each item of post-operative complications had a score of one if present and a score of zero if not present. Validity and reliability: Content and face validity and reliability of the tools were checked by five experts from the medical- surgical nursing for judgment of clarity, comprehensiveness, relevance of sentences, and appropriateness of content. Modifications were done based on their recommendations. The internal consistency of the tools was conducted by Chronbach alpha test and the tools showed good reliability as follows: HCPs' knowledge assessment questionnaire = 0.894, HCPs' safety practices observational checklist = 0.870, Safety attitude questionnaire = 0.792, Post-operative complications questionnaire = 0.91.

Official approval and permissions from the director of the hospitals in Makkah and the heads of the OR and surgical departments were obtained. All the participants gave informed consent after receiving full explanations about the study's aims. Participation in the study was voluntary. The confidentiality of participants' data was assured through coding of all data. In addition, the participants were informed that they could refuse or withdraw from the study at any time without giving any reason.

A pilot study was conducted before starting the main study data collection on 10% of study subject (8 HCPs and 10 patients) to assess the recruitment feasibility and the applicability of the tools. Participants who took part in the pilot study were included in the main study sample since there was no difference in the recruitment process. The results of the pilot study confirmed that the study was feasible.

Data collection was completed over period of six months from beginning of January 2024 to end of July 2024. The collected data were organized, tabulated and statistically analyzed using the statistical package for social sciences (SPSS), version 28. For numerical data, the mean and standard deviation were calculated. Qualitative data were presented as frequencies and percentages. Comparison between groups was done by t-test test. P value \leq 0.05 was considered statistically significant.

RESULTS

Table (1): Shows that 45.9% of the studied HCPs aged from 40 to less than 50 years with a mean age (47 ± 2.98). 54.1% of them were male and 57% of them had diploma education, while, 40.2% of the studied HCPs

had 1 to less than 5 years of experience at operating room. 51.3% of the studied HCPs attended training program related to surgical safety and 81.1% of them attended since 3 to less than 10 years.

Table 1: Frequency and percentage distribution of the studied HCPs according to their demographic characteristics (N= 72)

| HCPs characteristics | No | % |
|--|----|------|
| Age | | |
| 20<30 | 32 | 44.4 |
| 30<40 | 2 | 2.7 |
| 40<50 | 33 | 45.9 |
| 50-60 | 5 | 7.0 |
| Mean=47±2.984 | | |
| Gender | | |
| Male | 39 | 54.1 |
| Female | 33 | 45.9 |
| Qualification | | |
| Diploma | 41 | 57.0 |
| Technicalinstitute | 7 | 9.7 |
| University | 24 | 33.3 |
| Postgraduate | 0 | 0.0 |
| Years of experience at the OR | | |
| <1 | 5 | 7.0 |
| 1<5 | 29 | 40.2 |
| 5<10 | 22 | 30.6 |
| ≥10 | 16 | 22.2 |
| Mean=3.6±1.6 | | |
| Attendance of training program related to surgical safety | | |
| Yes | 37 | 51.3 |
| No | 35 | 48.7 |
| Duration after attending the training program | | |
| <3 | 5 | 18.9 |
| 3<10 | 30 | 81.1 |
| ≥10 | 0 | 0.0 |

Table (2): Illustrates that there were high statistically significant differences between the HCPs' mean scores of knowledge regarding surgical safety pre and post implementation of surgical safety guidelines except for their knowledge regarding HCP role to maintain patient's safety during operative time.

Table 2: Comparison of mean scores of HCP' knowledge regarding surgical safety pre and post implementation of surgical safety guidelines (N=72)

| HCP's knowledge | Pre | Post | T test | P |
|---|------------|------------|--------|---------|
| | Mean±SD | Mean±SD | | |
| ▪ Definition of surgery | 3.14± 0.60 | 5.42± 0.70 | 20.98 | 0.000** |
| ▪ Phases of surgery | 3.46± 0.64 | 5.6±0.38 | 24.39 | 0.000** |
| ▪ Threats of patient safety at operating room | 4.14± 1.01 | 5.22± 0.81 | 7.078 | 0.000** |
| ▪ Nursing role to maintain patient's safety before operative time | 3.06± 0.75 | 5.4±1.02 | 15.68 | 0.000** |
| ▪ Nursing role to maintain patient safety during anesthesia | 2.11± 0.50 | 5.22± 0.81 | 27.72 | 0.000** |
| ▪ Nursing role to maintain patient's safety during operative time | 5.52± 0.42 | 5.6±0.38 | 1.19 | 0.461 |

**P<0.001 High statistically significant

Table (3): Indicates that 100% of circulating HCPs ensured availability of equipment and needed supplies, confirmed patient identity, type and site of operation and ensured environmental hygiene and disinfection post implementation of surgical safety guidelines.

Table 3: Comparison of circulating HCPs' practices regarding surgical safety pre and post implementation of surgical safety guidelines (N=30).

| Items | Pre- intervention | | Post-intervention | |
|--|-------------------|-------|-------------------|-------|
| | N | % | N | % |
| ▪ Ensuring environmental safety | 21 | 70.0 | 29 | 96.7 |
| ▪ Ensuring availability of equipment and needed supplies | 25 | 83.3 | 30 | 100.0 |
| ▪ Confirmation of patient's identity | 25 | 83.3 | 30 | 100.0 |
| ▪ Confirmation of type of operation | 15 | 50.0 | 30 | 100.0 |
| ▪ Confirmation of site marked | 22 | 73.3 | 30 | 100.0 |
| ▪ Confirmation of written consent | 11 | 36.7 | 26 | 86.7 |
| ▪ Preparation of patient for surgery | 18 | 60.0 | 28 | 93.3 |
| ▪ Bleeding risk assessment | 17 | 56.7 | 25 | 83.3 |
| ▪ Difficult airway or aspiration risk assessment | 13 | 43.3 | 27 | 90.0 |
| ▪ Safe positioning of patient | 28 | 93.3 | 28 | 93.3 |
| ▪ Assessing for risk for allergy | 21 | 70.0 | 27 | 90.0 |
| ▪ Repeat counting of instrument with scrub nurse | 22 | 73.3 | 28 | 93.3 |
| ▪ Ensure environmental hygiene and disinfection | 30 | 100.0 | 30 | 100.0 |
| Total(mean±SD) | 8± 2.4 | | 10±2.1 | |
| | Ttest | | 12.015 | |
| | P value | | <0.001** | |

Table (4): Reveals that 100% of scrub HCPs performed surgical safety practices post implementation of surgical safety guidelines except for introducing themselves by name and role.

Table 4: Comparison of scrub nurses' practices regarding surgical safety pre and post implementation of surgical safety guidelines (N=30).

| Items | Pre- implementation | | Post-implementation | |
|--|---------------------|-------|---------------------|-------|
| | N | % | N | % |
| ▪ Hand scrubbing | 30 | 100.0 | 30 | 100.0 |
| ▪ Gowning | 30 | 100.0 | 30 | 100.0 |
| ▪ Gloving | 30 | 100.0 | 30 | 100.0 |
| ▪ Skin antisepsis | 30 | 100.0 | 30 | 100.0 |
| ▪ Introduce themselves by name and role | 19 | 63.3 | 27 | 90.0 |
| ▪ Confirm patient identity | 22 | 73.3 | 30 | 100.0 |
| ▪ Confirms site of surgery | 30 | 100.0 | 30 | 100.0 |
| ▪ Confirm procedure | 27 | 90.0 | 30 | 100.0 |
| ▪ Draping the patient | 27 | 86.7 | 30 | 100.0 |
| ▪ Counting instrument Before | 27 | 90.0 | 30 | 100.0 |
| ▪ Counting instrument after | 20 | 66.7 | 30 | 100.0 |
| ▪ Handling surgical equipment to surgeon aseptically | 28 | 93.3 | 30 | 100.0 |
| ▪ Specimen labeling | 27 | 90.0 | 30 | 100.0 |
| ▪ Cleansing instruments | 28 | 100.0 | 30 | 100.0 |
| ▪ Disinfecting instruments | 30 | 100.0 | 30 | 100.0 |
| ▪ Sterilization instruments | 30 | 100.0 | 30 | 100.0 |
| Total(mean±SD) | 13.0± 2.1 | | 14.0± 1.6 | |
| | Ttest | | 11.165 | |
| | P value | | <0.001** | |

Table (5): Shows that 100% of anesthesia nurses performed surgical safety practices post implementation of surgical safety guidelines.

Table 5: Comparison of anesthesia HCPs' practices regarding surgical safety pre and post implementation of surgical safety guidelines (N=12)

| Items | Pre- implementation | | Post-implementation | |
|---|---------------------|-------|---------------------|-------|
| | N | % | N | % |
| ▪ Patients preparations before anesthesia | 12 | 100.0 | 12 | 100.0 |

| | | | | |
|--|---------|-------|----------|-------|
| ▪ Frequent monitoring and evaluation of anesthetized patient condition | 12 | 100.0 | 12 | 100.0 |
| ▪ Prophylactic antibiotics administration | 9 | 75.0 | 12 | 100.0 |
| ▪ Immediate post-anesthesia care(during recovery) | 11 | 91.7 | 12 | 100.0 |
| ▪ Safe transferring of patient to post anesthesia care unit | 11 | 91.7 | 12 | 100.0 |
| Total(mean±SD) | 3.5±0.6 | | 4.7±0.01 | |
| | Ttest | | 14.022 | |
| | P value | | <0.001** | |

Table (6): Illustrates that there were high statistically significant differences between the nurses' attitudes regarding reporting any safety concerns and working with physicians as a well-coordinated team post implementation of surgical safety guidelines, as well, there was a statistically significant difference between nurses' attitudes regarding disregarding rules established for the OR.

Table 6: Comparison of studied HCPs' attitudes regarding surgical safety pre and post implementation of surgical safety guidelines (N=72)

| Items | Pre | Post | Ttest | P value |
|---|--------------|--------------|-------|---------|
| | Mean±SD | Mean±SD | | |
| ▪ Feeling safe being treated here as a patient | 32.21± 25.3 | 34.56± 24.35 | 0.32 | 0.75 |
| ▪ Briefing OR personnel before a surgical procedure is important for patient safety | 80.15± 24.6 | 86.6± 19.5 | 1.3 | 0.16 |
| ▪ Encouragement by colleagues to report any safety concerns. | 68.5± 24.05 | 76.5± 13.2 | 6.3 | 0.000** |
| ▪ In the OR, it is difficult to speak up when perceiving a Problem with patient care*** | 63.06± 26.5 | 69.7± 72.27 | 2.5 | 0.20 |
| ▪ The physicians and nurses work together as a well-coordinated team | 55.36± 28.42 | 68.6± 26.4 | 5.3 | 0.000** |
| ▪ Personnel frequently disregard rules or guidelines that are Established for the OR*** | 49.8± 27.8 | 60.3± 29.8 | 3.5 | 0.031* |

*Statistically significant

***these statements reverse-scored

**High statistically significant

Table (7): Presents that 55% of the studied patients aged from 45 to less than 60 years with a mean age (42.3 ± 6.23). 65% of them were male and 42% of them had history of hypertension, as well, 64% of the studied patients stayed for 5 to less than 10 days at hospital. Considering operative characteristics, 41% of the studied patients had general anesthesia and 47% of them underwent gastrointestinal surgical procedure.

Table 7: Frequency and percentage distribution of the studied patients according to their demographic and operative characteristics (N= 100)

| Variable | No | % |
|-------------------------------------|----|------|
| Age | | |
| 18<30 | 30 | 30.0 |
| 30<45 | 15 | 15.0 |
| 45-60 | 55 | 55.0 |
| Mean=42.3 ±6.23 | | |
| Gender | | |
| Male | 65 | 65.0 |
| Female | 35 | 35.0 |
| Chronic diseases | | |
| Diabetes mellitus | 12 | 12.0 |
| Hypertension | 42 | 42.0 |
| Cardiac problems | 30 | 30.0 |
| Length of hospital stay(day) | | |
| 1<5 | 11 | 11.0 |
| 5<10 | 64 | 64.0 |
| ≥10 | 25 | 25.0 |
| Mean=5.6±1.8 | | |
| Type of anesthesia | | |
| General | 41 | 41.0 |

| Variable | No | % |
|-----------------------------------|----|------|
| epidural | 24 | 24.0 |
| Spinal | 35 | 35.0 |
| Type of surgical procedure | | |
| Gastrointestinal | 47 | 47.0 |
| Vascular | 29 | 29.0 |
| Orthopedic | 24 | 24.0 |

Table (8): Reveals that there were high statistically significant reduction of some post-operative complications post implementation of surgical safety guidelines as surgical site infection, respiratory pneumonia and more than 2 complications.

Table 8: Comparison of post-operative complications among the studied patients pre and post implementation of surgical safety guidelines (N=100)

| Complications | Pre-implementation | | Post-implementation | | z | P |
|---|--------------------|------|---------------------|------|------|---------|
| | No | % | No | % | | |
| Surgical site infection (SSI) | 37 | 37.0 | 11 | 11.0 | 4.3 | 0.001** |
| Respiratory pneumonia | 18 | 18.0 | 3 | 3.0 | 3.46 | 0.000** |
| DVT/Pulmonary embolism | 2 | 2.0 | 0 | 0.0 | 1.42 | 0.16 |
| ICU and ventilator use \geq 48 hours | 20 | 20.0 | 13 | 13.0 | 1.33 | 0.18 |
| Bleeding that needed more than 4 Blood units of blood transfusion | 19 | 19.0 | 5 | 5.0 | 3.05 | 0.002* |
| Unplanned return to the OR | 15 | 15.0 | 2 | 2.0 | 3.29 | 0.009* |
| Death | 10 | 10.0 | 6 | 6.0 | 1.04 | 0.29 |
| \geq 2 Complications | 75 | 75.0 | 53 | 53.0 | 3.24 | 0.001** |

*Significant(S) $p > 0.05$

**Highly significant(HS) $p > 0.001$

DISCUSSION

Concerning the age of the studied HCPs, the results of the present study revealed that less than half of the studied HCPs aged from 40 to less than 50 years and more than half of them were male. This result is consistent with Zingiryan et al., (2017)⁽²³⁾, who conducted their study in USA about "Implementation of the surgical safety checklist at a tertiary academic center: Impact on safety culture and patient outcomes" and mentioned that less than half of the studied HCPs were aged from 40 to less than 60 years and half of them were male. This might explain that HCPs are aware enough to the nature of OR work. Regarding HCPs' level of education, the present study showed that more than half of the studied HCPs had diploma education certificates as their highest qualification. This result is in agreement with Mukhtar & Ahmed (2019)⁽¹⁷⁾, who studied the impact of a design propose program for HCPs about patient safety and denoted that about two thirds of the study sample had diploma education.

As regards to years of experience, this study results mentioned that less than half of the studied HCPs had 1 to less than 5 years of experience at the operating room. This result is inconsistent with Hassan et al., (2018)⁽¹⁸⁾, who assessed the quality of care provided to patients in the operating room, based on ministry of health standard of care and revealed that more than half of HCPs had working experience in operating room of 1-5 years. It may due to the need of highly skilled personnel to work in operating room and which may minimize errors and improve quality of care.

As concerns to attendance of training program related to surgical safety, the study results showed that half of the studied HCPs attended training program related to surgical safety and the majority of them attended since 3 to less than 10 years. This result was incongruent with a study done by Mukhtar & Ahmed (2019)⁽¹⁷⁾, who denoted that most of the studied HCPs didn't receive any training course about patient safety. This may be due to availability of training chances provided by healthcare authorities and reflected that the hospital policy focus on continuous feedback and training.

Considering HCPs' level of knowledge regarding surgical safety, the current study revealed that there were high statistically significant differences between the HCPs' mean scores of knowledge regarding surgical safety pre and post implementation of surgical safety guidelines except for their knowledge about nursing role to maintain patient's safety during operative time. This result is in the same line with Fadllalah & Ibrahim, (2019)⁽¹⁶⁾, who reported in their study about "Effect of proposed program of patient safety on HCP's knowledge and quality of care at hospitals", that there was an improvement in HCPs' knowledge mean scores after implementing of training program with high statistically significant differences. This proves the effectiveness of the surgical safety guidelines on improving HCPs' knowledge regarding surgical safety.

The present study illustrated that all circulating HCPs ensured availability of equipment and needed supplies,

confirmed patient's identity, type and site of operation and ensured environmental hygiene and disinfection post implementation of surgical safety guidelines. This finding is consistent with Hassan et al., (2018)⁽¹⁸⁾, who found that the performance of the circulating HCPs after the operation was better compared to before and during the operation, with about one third of them had total adequate performance.

This could be attributed to the effectiveness of conducting surgical safety guidelines. The current findings showed that all scrub HCPs performed surgical safety practices post implementation of surgical safety guidelines except for introducing themselves by name and role. This may be due to the effect of surgical safety guidelines on enhancing HCPs' performance. This finding is congruent with Mohamed et al., (2020)⁽⁶⁾, in a study in Egypt, who studied "Effect of implementing an educational program on HCPs' performance regarding intraoperative surgical patient safety", revealed that there was statistically significant difference in their scores regarding aseptic technique practices post program implementation.

The current study results indicated that all anesthesia HCPs performed surgical safety practices post implementation of surgical safety guidelines. This finding is consistent with Mohamed et al., (2020)⁽⁶⁾, who mentioned that there was a great improvement in studied HCPs' practices regarding patient safety along three phases of operation after program implementation.

As regards to the HCPs' attitudes regarding surgical safety pre and post implementation of surgical safety guidelines, the study results showed that there were high statistically significant differences between the HCPs' attitudes regarding reporting any safety concerns and working with physicians as a well-coordinated team post implementation of surgical safety guidelines, as well, there was a statistically significant difference between HCPs' attitudes regarding disregarding rules established for the OR. This result is supported by Hababbeh&Alkhalailah (2020)⁽²⁴⁾, in their study entitled "Effect of an educational program on the attitudes towards patient safety of operation room HCPs", in Jordan, they stated that OR HCPs' attitudes towards patient safety were significantly improved after the program.

Concerning the age of the studied patients, the results of the present study revealed that more than half of the studied patients aged from 45 to less than 60 years, more than half of them were male and less than half of them had history of hypertension. This result is inconsistent with Mohamed et al., (2017)⁽²¹⁾, in Egypt, who assessed the effect of intraoperative nurses' safety practices on postoperative adverse events among surgical patients undergoing general anesthesia and mentioned that more than half of studied patients' age is 35 years or more than half of them are female and don't suffer from comorbid disease.

Considering operative characteristics of the studied patients, the results of the present study mentioned that less than half of the studied patients had general anesthesia and underwent gastrointestinal surgical procedure. This finding is consistent with Sonoda, et al., (2018)⁽²²⁾ in Japan, who evaluated operating room HCPs' perception of teamwork performance and their level of mental stress and found that more than half the surgical procedures were endoscopic surgery. The current study results indicated that there were high statistically significant reduction of some post-operative complications post implementation of surgical safety guidelines as surgical site infection, respiratory pneumonia and more than 2 complications.

This result was in the same line with AboelSeoud et al., (2015)⁽²⁰⁾, whose study aimed to improve the safety of surgical care to decrease morbidity and mortality associated with surgery at Zagazig University Hospital, and reported that surgical site infection, pneumonia, bleeding and unplanned return to OR were significantly lower among post-intervention than pre-intervention group. These improvements may be due to the effectiveness of surgical safety guidelines to prevent these complications

CONCLUSION

According to the results of the current study; the HCPs' implementation of surgical safety guidelines had a positive effect on HCPs' performance and on reduction of post-operative complications. Recommendations: The surgical safety guidelines should be implemented as part of the daily surgical routine and encourages its use in all surgical operations. Provide surgical safety guidelines posters and brochures, which include measures on patient safety, especially at the operating rooms.

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