

Assessment of nurses' practices related to safety of intraoperative surgical patient undergoing general anesthesia.

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Abstract: Human errors play an important role in the occurrence of surgical complications that interfere with patient's safety. This study aimed to assess the nurses' safety practices related to safety of intraoperative surgical patient undergoing general anesthesia. The study was carried out at the operating room of the Main University Hospital (A&B&C). Nurses' safety practices observational checklist was used for data collection. The study revealed that the nurses' level of safety practices was unsatisfactory along the phases of surgery with no significant correlation with presence of patient's associated diseases, nurses' years of experience or previous attendance of training programs in the majority of patients.

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1. Introduction:

Surgery is an invasive special medical procedure performed on all parts of the human body to diagnose or treat illness, correct deformities and defects, repair injuries and cure certain diseases. General surgery is the basis for all surgical specialties that emerged as a result of understanding the etiology of various disease processes and using treatment for various parts of the body. Each specialty involves surgical procedures performed on a specific body system or anatomic region. ^(1,2)

Human errors play an important role in the occurrence of surgical complications that interfere with patient's safety. These errors may occur as a result of improper practice for identifying the patient, inadequate preoperative evaluation, ignorance of important clinical history as drug allergies, failure to confirm that all required instruments, devices and blood products are on hands, negligence to display essential images and administer the prophylactic antibiotics, improper disinfection and sterilization of equipment and instrument, inappropriate labeling of specimen, omission of sponges, needles and instrument. In addition to these recurring errors of omission, human factors that contribute to poor surgical outcomes and lacking of surgical patient's safety include inexperience, poor judgment and miscommunication. ⁽³⁻⁷⁾

In 2004, many studies showed that the annual volume of major surgeries was estimated to be 187-281 million operations or approximately one operation annually for every one 25 human being alive. While the rate of major complications has been documented to occur in 3-22% of inpatient surgical procedures, and

the death rate ranged from 0.4-0.8%. Nearly half of these adverse events are preventable. So surgical patient safety especially under general anesthesia has therefore emerged as a significant global health concern. ⁽⁵⁻⁷⁾

Safe and effective intraoperative care requires team effort. Each member of the surgical team brings unique skills that must be coordinated to achieve the desired patient's outcomes. Each member of the surgical team must be familiar with specific surgical procedures, adhere to policies and procedures and be able to adhere quickly to alterations in the patient's condition and surgical procedure. ⁽⁸⁾

Patient safety has received increased attention in recent years but mostly with a focus on the epidemiology of errors and adverse events, rather than on practices that reduce such events, so this study will be undertaken to assess the nurses' practices toward safety of intraoperative surgical patient undergoing general anesthesia that will have a great impact on the nursing quality and nursing improvement at all. ^(9,10)

All surgical patients should pass through three phases called perioperative phases which include the preoperative, intraoperative and post operative phases of surgical experience. During these phases the nurses have an important role. ^(8,11)

Nursing management during the intraoperative period depends on routine tasks performed during surgery as well as on variables such as type of surgery performed, type of anesthesia used, patient's age and conditions, and any complications. Nurses who work in the operating room (scrub, circulating nurse and anesthesia nurse) function as a patient's chief advocate. Attention focuses on the psychologic as well as physiologic reactions of the

patients. Physiological reactions include; assessing the patient continuously and protecting him from potential complications which include infection, fluid volume excess or deficit, injury related to positioning, hypothermia and malignant hyperthermia.⁽¹²⁾

Alex (2009) reported that nursing practices performed during the intraoperative phase directed toward patient safety, facilitation of the procedure, prevention of infection, and balanced physiological response to anesthesia and surgical intervention.⁽⁴⁾

The intraoperative phase is classified into: Sign in: which means before induction of anesthesia and includes such practices: confirming the patient identity; type, site and side of operation, complete written informed consent, assessing the patient for liability of blood loss, airway difficulty and allergic reaction. **Time out:** It means the time after induction of anesthesia and before the skin closure which includes several items to check such as explain any specific risk in the patient condition, assure administration of prophylactic antibiotic, verify that all necessary equipment and instruments are on hand and functioning and confirming the sterility of instrument. **Sign out:** It refers to the time at the completion of the procedure and before wound closure is completed. It includes safe handling of surgical specimens, double counting of needles, sponges and instruments. In addition, monitoring the patient vital signs in order to ensure safe recovery from anesthesia.⁽¹²⁻¹⁵⁾

In summary, the operating room nurses have an important role to play in the care of patients undergoing general surgery to prevent complications and maintain patient safety. This beneficial role will not be achieved unless these nurses follow professionalism. This includes; demonstrates punctuality, maintaining good attendance records, adhering to codes and standards of operating room. Nurses should be aware of personal limitations and open to constructive criticism, constantly seeking to improve and maintain positive attitude.⁽¹⁶⁾

The health care environment is laden with hazards for the patients and the caregiver. These hazards include physical, chemical, biological and psychological hazards. Safety in surgery requires a reliable execution of multiple necessary steps in care, not just by the surgeon but by the team of health care professionals working together for the benefit of the patient.⁽¹⁷⁾

Many nursing responsibilities contribute to the operating room nurses for implementing each scheduled procedure in a manner that ensures the safety of patients and personnel in an efficient, effective and compassionate manner. One of these responsibilities is knowing and implementing appropriate and accepted standards of practice.⁽³⁾

The National Forum for Quality and Measurement and Reporting (the National Quality Forum) defines a patient safety practice as a type of

process or structure whose application reduce the probability of adverse events resulting from exposure to the health care system a cross the range of disease or procedure⁽¹⁸⁾

So, it is necessary to determine the most common risks and hazards that the surgical patient faces during surgical experience including the administration of general anesthesia which includes: Risk for injury, risk for operating the wrong patient or wrong site, risk for anesthesia complications, risk for allergy or adverse drug reaction, risk for post operative surgical site infection, risk for foreign body retention, and risk for incorrectly identifying the surgical specimens.⁽¹⁹⁻²²⁾

A strategy for intraoperative safety practices was developed and include equipment safety, electrical safety, radiational safety and chemical safety. Proper positioning ensures patient comfort and safety, preserves vascular supply, and prevents neuromuscular damage to tissue. At the same time, positioning also provides access to the surgical site, airway, intravenous lines, and all monitoring devices. Prevention of injury includes careful movement during positioning, use of appropriate positioning methods, and use of protective devices such as side rails and safety strips. Safe transfers of the patient to or from the operating room bed with all tubes are visible. Maintaining body temperature, achievement of safe anesthesia, continuous surgical asepsis, safe handling of surgical specimens, prevention of foreign body retention, operating the correct patient and team communication are the most important points that must be considered to achieve safe surgery.⁽²³⁻⁶⁾

2. Material & Methods

Material

Research design:

A descriptive study research design was used to assess the operating room nurses' practices related safety of intraoperative general surgical patients undergoing general anesthesia.

Setting:

The study was carried out in the operating rooms of the Alexandria Main University Hospital (A&B&C)

Subjects:

The subjects of this study consisted of two groups. **Group I:** consisted of all operating room nurses (24 nurses) who were assigned for management of intraoperative general surgical patients in the previously mentioned settings. There were distributed as (7) nurses in operating room A, and (9) nurses in operating room B, in addition to (8) nurses in operating room C. **Group II:** a convenient sample of 60 intraoperative general surgical patients who received general anesthesia undergoing different types of surgical operations to be 20 for each setting.

Tool:**Operating Room Nurses' safety practices observational checklist:**

This tool was developed by the researcher after reviewing the current national and international related literature to observe the operating room nurses' practices regarding safety of intraoperative general surgical patients undergoing general anesthesia during general surgeries at the three phases^(1,3,4,7,37,44) It was comprised items related to: **Part I:** this part included items related to the sociodemographic data of patients such as age, sex, diagnosis, type of operation, associated diseases and history of previous surgery and type of anesthesia given.

Part II: included items related to the biosociodemographic and clinical data of nurses such as name of the assigned nurses, qualification, position, years of experience, area of working and previous attendance of training programs related to general anesthesia and patient safety.

Part III: included items related to the practices performed by the operating room nurses to maximize and ensure safety of intraoperative general surgical patient undergoing general anesthesia. These items were observed by the researcher during the three phases for 20 patient for each previously mentioned setting as follows

Phase I: Sign in (Before induction of anesthesia): Included all operating room nurses practices toward intraoperative patient safety in the period of receiving the patient in the operating room until before induction of anesthesia containing (92) items such as practices related to environmental safety, preparing the operating room with necessary equipments and patient preparation for anesthesia and surgery. **Phase II: Time out** It referred to the period ranged from anesthesia induction until before skin closure included (44) items that include assistance during induction of anesthesia, following the principles of aseptic technique, and maintenance of general anesthesia. **Phase III: Sign out:** included all practices done at the completion of the surgical operation which are (66) items such as handling of surgical specimens, immediate post operative care and environmental hygiene.

Scoring system:

Each practice or main category included sub-practices or procedures which were translated into items. The score of each practice was distributed as follow: Done correct = 2, done incorrect = 1, Not done = 0, done by others =D.

Method

1. **Approval** to conduct the study was obtained from the responsible authorities of the Alexandria Main University Hospital after providing an explanation of the study aim.

2. The **tools** were developed by the investigator based on the recent relevant literature.^(1,3,4,7,37,44) Content validity was tested by 5 (professors)experts in the field of medical surgical nursing. Accordingly, all necessary modifications were done.
3. Tool was tested for its **reliability** using Cronbach_ Alpha Coefficient Statistical test which revealed that the reliability of the tool was 0.914 which indicate high reliability.
4. **A pilot study** was carried out after the development of tools. It was carried out on 5 intraoperative general surgical patients undergoing general anesthesia (surgical operation) in the previous mentioned setting; the aim of pilot study was to ensure clarity, applicability, and feasibility of the tools.
5. The investigator explained the purpose of the study to nurses and patients including in the study. Nurses' and patients' formal **consent** to participate in the study were obtained, and every nurse and patient were informed that confidentiality will be assured
6. The selected intraoperative general surgical patients are selected according to the availability and frequency of operations in the previous mentioned settings during the morning shift to be 20 general surgical patients from each previous mentioned setting.
7. Safety practices done for each intraoperative general surgical patient undergoing general anesthesia was observed by the researcher using tool I (Nurses safety practices observational checklist) regardless the specific role of each nurse.
8. The data obtained are collected and tabulated using appropriate statistical analysis.

The data was collected during a period of 6 months (from the beginning of June 2011 up to December 2011).

Statistical analysis:

- After data collection, it was coded and entered to the computer.
- The data was checked for correction of any errors during data entry.
- SPSS program version 13 was used for data presentation (tables, graphs and mathematical presentations) and statistical analysis.
- Number and percents were used for presenting qualitative variables.
- Mean and mean percent were carried out for the quantitative variables.
- The 0.05% level of significance was used.

Scoring system for grading nurses' practices:

- A score > 65 % was considered satisfactory.
- A score ≤ 65 % was considered unsatisfactory.
- Scoring system related to correlation:

- Fissure Exact test was done to determine the correlations between the nurses' level of safety practices and their years of experience, attendance of training programs or presence of patient's associated diseases.

Correlations were calculated:

- Less than or equal 0.05 was considered significant correlation. Less than or equal 0.01 was considered highly significant correlation.

3. Results

The study revealed that 40% of patients were aged from 20 to less than 35 years old, 36.7 %were from 35 to less than 50 years, and 23.3% were over than 50 years old. While 21.7% performed cholecystectomy and 15% performed thyroectomy operations. In relation to the presence of patient with associated diseases the same table showed that 78.3% of patients have no associated diseases, 15% of patients were hypertensive while 6.7% of patients have heart disease. Regarding the patient's past experience of surgery, 78.3% of patients have no previous surgery and only 21.7 % of patients have a previous surgical experience

As regards to the frequency distribution of the studied nurses in relation to their demographic characteristics per patients, this study showed that all of the studied nurses (100%) were having diploma of the nursing secondary school. Regarding to their experience, 46.7% were have experience from 15 to less than 25 years and 31.7 % of studied nurses were from 5 to less than 15 years of experience, 21.7% less than 5 years of experience and no nurses have experience more than 25 years were involved in direct patient care. Also, it revealed that most of the studied nurses (90%) had no training programs related to anesthesia and patient safety while only (10%) of nurses attended some sorts of training programs.

Table 1 portrays the frequency distribution of safety practices mean score percent regarding caring of the patient during the first phase of surgery (sign in). It was noticed that practices related to **mechanical safety** were done correctly by the operating room nurses in more (63%) of intoperative patients; practices related to **thermal safety** were done correctly more than (85%) of patients. Also, it was found that practices related to **electrical safety** were done correctly in more than (87%) of patients. In about two thirds (68.3%) of intraoperative surgical patients; the practices concerning **bacteriological safety** were done correctly by the operating room nurse. The table shows that practice related to **chemical safety** was done correctly in (76.7 %) of patients

Furthermore, the results indicated that all practices relating to **prepare the operating room with necessary and basic equipment** were correctly done for nearly all patients involved in the study.

Regarding **preparing the anesthesia machine, preparing the monitors and the crush car**, the table revealed that these practices were done correctly for more than (80%) of patients.

Regarding patient preparations such as taking history and emotional support; the results revealed that these practices were done correctly for only (7.5%) of patients while there were not done at all for more than two thirds of patients (76.6%). Concerning team oral confirming of the operation, this table showed that was confirming correctly for (21.6%) of patients while not done in (70.5%) of patients. In relation to check the patients for the presence of certain objects such as artificial teeth and jewelers, this table showed that it was done correctly for around one third of patients(29.9%) while not done for (63.3%) of patients. Concerning practices related to assuring that the patient is ready for surgery such as fasting for at least 6-8 hours and wearing clean cotton gown, this table showed that these were not checked for (82%) of patients. Regarding prepare the patient for anesthesia, it was done correctly for approximately one quarter of patients while not by the nurses at all in about (59%) of patients but done by other members (anesthesiologist)for about (12%) of patients.

Table 2 presents the frequency distribution of safety practices mean score percent regarding caring of the patient during the second phase of surgery (time out) It was found that practices related to safe induction of anesthesia were done incorrectly in about one third of patients not done by nurses in about (40%) of patients while done by others (anesthesiologist) in (17.1%) of patients.

Regarding oral confirming of operating the correct patient, procedure, site and side, the table showed that was not done for more than (93%) of patients.

Concerning nurses' compliance with the principles of aseptic techniques; the finding showed that it was followed correctly for nearly one half of patients. However, it was incorrectly done in (32.5%) while not done in (20.7%) of patients. Regarding draping procedure, it was noticed that draping was done correctly in (53.5%) of patients while it was not correctly done in approximately one quarter of patients. Also, this table clarified that practices concerning preparing the mayo stand and surgical setup with necessary equipment were done correctly for (96.7%) of patients. In relation to skin preparation, it was done correctly in nearly two thirds of patients while done incorrectly in (42.5%) of patients. As regards to safe handling of surgical instruments, it was done correctly for (54.4%) of patients while done correctly in about (33%) of patients.

Moreover, table 2 showed that two thirds of intraoperative surgical patients (61.1%) were received

practices concerning monitoring of general anesthesia by other members (Anesthesiologists), while done correctly by nurses in only (23.6%) of patients.

Table 3 reveals the frequency distribution of safety practices mean score percent regarding caring of the patient during the second phase of surgery (time out). This table revealed that practices concerning oral reviewing of the surgical operation were not done in more than (86.71%) of patients. Concerning safe handling of laboratory and tissue specimens, it was done incorrectly in more than (78.6%) of patients. It was observed that the nurses correctly repeat the count of instruments, needles, sponges and towels in approximately (87%) of patients.

Moreover, this table illustrated that most of practices regarding immediate post operative care were done by other members (anesthesiologists) for at least (61.5%) of patients. While done correctly by nurses for only (20%) of patients. Concerning practices related to recording of anesthesia, there were done correctly by nurses in (20%) of patients. In the other hand there were not done in (67.7%) of patients.

Also, this table clarified that practices related to caring of surgical instruments immediately after the procedure was done correctly for more than (82%) of patients. In addition, practices concerning cleaning of instruments were done correctly in (85.8%) of patients. Regarding disinfection of instruments, it was done correctly in about one third of patient (26.9%) while not done in the other two thirds (63.3%). As regards to preparing the instrument for sterilization, it was observed that was done correctly in (88.3%) of

patients. In relation to sterilization of instrument by autoclave, this table showed that it was done correctly in (80.8%) of patients and incorrectly done in only (13.3%) of patients. Furthermore, this table illustrated that practices related to environmental hygiene were done correctly in more than one half of patients (59.3%) while done incorrectly in nearly (33.5%) of patients.

Figure I show the ranking of nurses' level of safety practices mean score in descending order in the third phase of surgery (Sign out) to be repeating the count of instruments, environmental hygiene, and handling of surgical specimens followed by immediate post operative care.

Figure 2 shows the ranking of nurses' level of safety practices mean score in descending order in the three phases: the maximum score of practices was for phase I (59.167 +/-7.7291) and phase II (55.227 +/-12.048) followed by phase III (54.381 +/-7.362).

Table 4 clarifies that there were statistically highly significant correlation between the presence of patient's associated diseases and nurses' level of practice during phase I and II (0.000).

Table 5 clarified that only during phase III; it was highly significant correlation between the nurse's previous attendance of training programs and their level of practice (0.002).

Table 6 showed that during phase II, it was significant correlation between the nurses' years of experience and their level of intraoperative safety practices during phase II (0.027) while during phase I and III the statistical difference were not significant.

Table (1): Distribution of Safety Practices regarding Care of Patients during First Phase of Surgery (Sign in):

Intraoperative patient safety practices	Intraoperative surgical patients (n=60)							
	Done C		Done I		N.D		Done by others	
	X	X%	X	X%	X	X%	X	X%
1- Environmental safety:								
Mechanical safety	37.6	63	4.4	7	7.8	13	10.2	17
Thermal safety.	52.5	87.5	0.8	13	6.3	10.4	0.5	0.8
Electrical safety.	52.3	87.2	1.3	2.2	5.7	9.4	0.7	1.1
Bacteriological safety.	41	68.3	9	15	10	16.6	0	0
Chemical safety.	46	76.7	2	3.3	12	20	0	0
2- Prepare the operating room with necessary equipment:								
Basic equipment	60	100	0	0	0	0	0	0
Anesthesia machine.	57.5	96.1	0.6	1.1	0.6	1.1	1	1.6
Monitors	48	80	0	0	12	20	0	0
Crush car	59.2	98.7	0	0	0.7	1.3	0	0
3- Patient preparations:								
▪ Taking history and emotional support.	4.5	7.5	5	8.3	46	76.7	4.3	7.3
▪ Oral confirmation of the operation	13	21.6	1.7	2.9	42.5	70.8	2.7	4.6
▪ Check the patient for presence of certain objects.	18	29.9	4	6.7	38	63.3	0	0
▪ Assure that the patient is ready for surgery.	10.2	17	0.5	0.8	49.2	82	0	0
▪ Prepare the patient for anesthesia.	14	23.3	3.7	6.2	35	58.8	7	11.7

Table 2: Distribution of Safety Practices regarding Care of Patients during Second Phase of Surgery (Time Out):

Intraoperative patient safety practices	Intraoperative surgical patients (n=60)							
	Done C		Done I		N.D		Done by others	
	X	X%	X	X%	X	X%	X	X%
▪ Induction of anesthesia	8.5	14.2	20.2	33.7	21	35	10.2	17.1
▪ The staff agreed orally on performing the correct operation on the correct patient at the correct site.	1	1.7	0	0	65	93.3	3	5
▪ Follow the principles of aseptic technique in wearing mask, gowning, gloving and scrubbing.	28	46.7	18.6	32.5	12.4	20.7	0	0
○ Draping procedure	23.1	53.5	13.5	22.5	14.3	23.9	0	0
○ Preparing Mayo stand and other surgical set up with necessary instrument, equipment and supplies.	58	96.7	2	3.3	0	0	0	0
○ Skin preparation	34.5	57.5	25.5	42.5	0	0	0	0
○ Handling of surgical instruments	32.4	54.4	20	33.3	7.3	12.2	0	0
▪ Maintenance of general anesthesia	14.2	23.6	3.6	9.2	5.4	9.1	41.2	61.1

Table (3): Frequency Distribution of Safety practices Concerning the Completion of Operation. Phase III

Intraoperative patient safety practices	Intraoperative surgical patients (n=60)							
	Done C		Done I		N.D		Done by others	
	X	X%	X	X%	X	X%	X	X%
➤ The team reviewed orally the operation that was performed	0	0	3.5	5.8	52	86.7*	4.5	7.5
➤ Handling laboratory and tissue specimen	8.4	14	47.1	78.6	4.4	7.4	0	0
➤ Repeat the count of instruments, needles, sponges and towels.	52	86.7	6	10	2	3.3	0	0
➤ Immediate postoperative care	9.6	16	1.3	2.1	12.3	20.4*	36.9	61.5*
- Record anesthesia chart	12.1	20.2*	2.8	4.6	40.6	67.7*	4.5	7.5
➤ Caring of the surgical instrument	49.7	82.8	0.3	0.6	10	16.7	0	0
▪ After the procedure								
▪ Cleaning instrument	51.5	85.8*	1.5	2.5	7	11.7	0	0
▪ Disinfection of the instrument	16.1	26.9*	5.9	9.8	38	63.3*	0	0
▪ Preparing instrument sets for sterilization	53	88.3*	1.2	1.9	5.8	9.7	0	0
▪ Sterilization of instrument by autoclave	48.5	80.8*	8	13.3*	2.5	4.2	1	1.7
Environmental hygiene.	35.6	59.3*	20.3	33.8*	4.2	6.9	0	0

Table (4): The Relation between Nurses' Intraoperative Safety Practices and Presence of Patient Associated Diseases:

		Common patient associated diseases										FET P
		Nothing		Heart disease		Hypertension		Diabetes Mellitus		Total		
		Count	%	Count	%	Count	%	Count	%	Count	%	
Phase I	Satisfactory	7	14.9	4	100	1	11.1	0	0	12	20	17.211
	Unsatisfactory	40	85.1	0	0	8	88.9	0	0	48	80	0.000*
Phase II	Satisfactory	8	17	4	100	1	11.1	0	0	13	21.7	15.651
	Unsatisfactory	39	83	0	0	8	88.9	0	0	47	78.3	0.000*
Phase III	Satisfactory	1	2.1	0	0	0	0	0	0	1	1.7	0.281
	Unsatisfactory	46	97.9	4	100	9	100	0	0	59	98.3	0.869

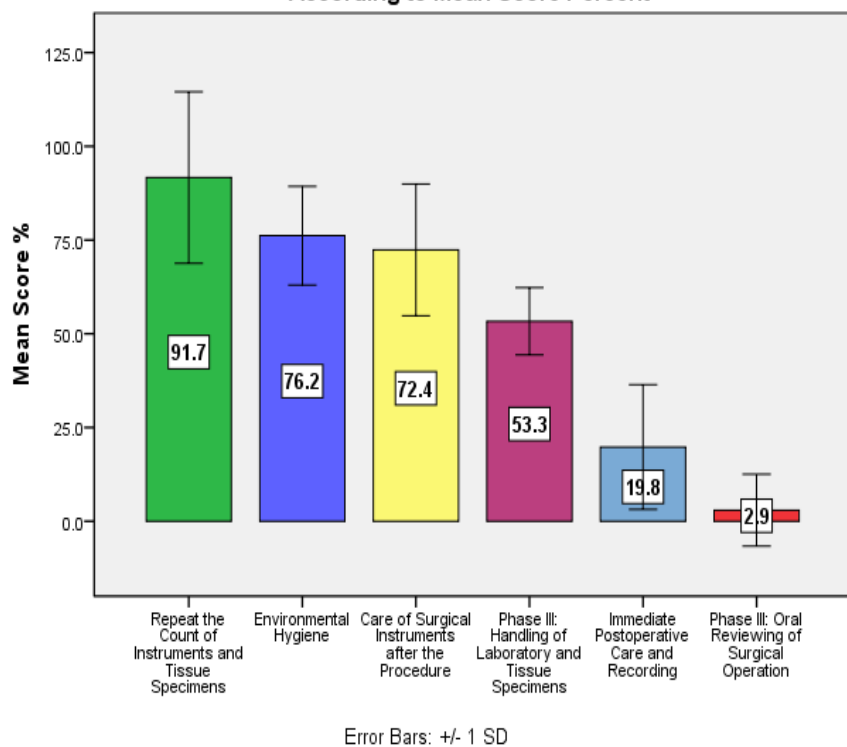
* = significance at $p \leq 0.05$ * = highly significance at $p \leq 0.01$

Table 5: The Relation between Nurses' Intraoperative Safety Practices and Attendance of Training Programs:

		Nurses previous attendance of training program						FET P
		No		Yes		Total		
		Count	%	Count	%	Count	%	
Phase I	Satisfactory	10	18.5	2	33.5	12	20	0.741
	Unsatisfactory	44	81.5	4	66.5	48	80	0.389
Phase II	Satisfactory	13	24.1	0	0	13	21.7	1.844
	Unsatisfactory	41	75.9	6	100	47	78.3	0.174
Phase III	Satisfactory	0	0	1	16.7	1	1.7	9.153
	Unsatisfactory	54	100	5	83.5	59	98.3	0.002*

* = significance at $p \leq 0.05$ * = highly significance at $p \leq 0.01$ **Table (6): The Relation between Nurses' Intraoperative Safety Practices and Their Years of Experience:**

		Nurses years of experience								FET P
		1 to less than 5		5 to less than 15		15 to less than 25		Total		
		Count	%	Count	%	Count	%	Count	%	
Phase I	Satisfactory	3	23.1	1	5.3	8	28.6	12	20	3.942
	Unsatisfactory	10	76.9	18	94.7	20	71.4	48	80	0.139
Phase II	Satisfactory	0	0	3	15.8	10	35.7	13	21.7	7.238
	Unsatisfactory	13	100	16	84.2	18	64.3	47	78.3	0.027*
Phase III	Satisfactory	0	0	0	0	1	3.6	1	1.7	1.162
	Unsatisfactory	13	100	19	100	27	96.4	59	98.3	0.559

* = significance at $p \leq 0.05$ * = highly significance at $p \leq 0.01$ **Phase III (Sign Out) Dimensions Ranked in Descending Order According to Mean Score Percent****Figure (2): Ranking of Nurses' Level of Safety Practices Mean Score in Descending Order in The Three Phases**

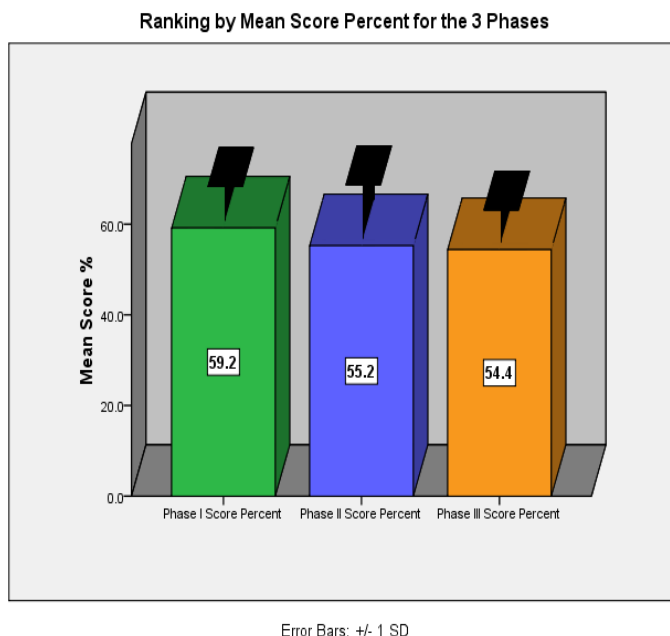


Figure (2): Ranking of Nurses' Level of Safety Practices Mean Score in Descending Order in The Three Phases.

4. Discussion:

Patient safety should be a top strategic priority for health care organizations and its leaders. Developing a patient safety culture was one of the recommendations made by the **WHO** to assist hospitals in improving patient safety. Assessing the organization's existing safety culture and practices is the first stage of developing a safety culture and the way to access the quality and accreditation. Therefore, we found that it is necessary to assess the actual safety practices done for the intraoperative patient undergoing general anesthesia in order to set a base for developing a plan for improvement and relief of any obstacles.⁽²⁷⁻⁹⁾

In the present study most of the studied patients' age ranged from 20 to less than 35 years. The highest percent of the studied patients had no associated diseases or previous surgical experiences. In relation to the studied nurses, the study showed that all nurses were having diploma of the secondary nursing school. The majority of nurses had from 15 to less than 25 years of experience and did not attend any patient safety or anesthesia training programs. The study showed that the nurses with more than 25 years of experience were not involved in direct patient care which increased the load on other nurses and led to false shortage of staff.

In relation to safety practices concerning phase I (sign in) such as environmental safety, the study results revealed that these practices were done correctly for the majority of surgical patients.

Cameron (2007) illustrated that maintaining environmental safety is important in all phases of surgical experience and identified the particularly important areas of safety in the intraoperative phase to be: mechanical safety, electrical safety, thermal safety, bacteriological safety and chemical safety which should be maintained by the operating room personnel in all phases of caring of the surgical patients.^(30, 31)

Saad (2007) stated that the majority of the operating room nurses agreed about environmental safety competencies. It may be due to nurse's control for most of the environmental situation in the operating room.⁽¹⁰⁾ Furthermore, they indicated that every patient undergoing general surgery has the right to receive some degree of safety in the environment.

Regarding preparing the operating room with necessary equipment such as basic equipment, monitoring devices and crash car, the study revealed that these practices were done correctly for approximately all patients. It may be due to the availability of these items in each operating theatre. Therefore, the nurses just checked for the efficiency of these equipments and considered it as a routine daily work.

Concerning patient's preparation before surgery, the study showed that few intraoperative surgical patients received emotional and psychological support. In this respect, **Heilkemper (2004)**, stated that prior to surgery the operating room nurses must provide psychological support in order to decrease the patient's anxiety.⁽³²⁾

Concerning oral reviewing of the patient's data, the study finding revealed that it was not done for the majority of patients. It may be related to lack of awareness about the importance of oral reviewing of the patient's data in decreasing the risk for operating the wrong patient, site or side of the operation or even performing a wrong procedure. It may be also related to that the surgeon considers the surgery as a routine work.

As regards assuring and checking the patient for the presence of certain objects such as jewelers and prostheses, assuring that the patient is ready for surgery and preparing the patient for anesthesia, the study showed that they were done incorrectly for a minority of patients, and were not done by nurses for the majority of patients while they were done by others (anesthesiologists). It may be due to nurses' shortage of staff, lack of confidence from the anesthesiologist and surgeons in nurses and the nurses' perception toward preoperative assessment for the patients' readiness and anesthesia related practices are the responsibilities of the anesthesiologists.

These results were supported by **Dever (2000)**, reported that the operating room nurses have inadequate performance regarding patient preparation for anesthesia⁽²³⁾. However these results were incongruent with **Wicker & Neill (2006)**, who stated that preoperative assessment and ensuring the patient identity, presence of essential laboratory and diagnostic studies, checking for presence of jewelers, hair pins and applying the electrucautery and positioning are core responsibilities of the operating room nurse.⁽³³⁾

Regarding to safety practices during phase II (time out) that includes practices such as nurse assistance during induction of anesthesia, this study revealed that these practices were not done by nurses for the majority of patients and were done by the anesthesiologist for the other patients. This can be due to shortage of operating room nurses which led to unavailability of anesthesia nurse for each operating theatre and lack of nurse's knowledge about anesthesia.

In this respect, **Saad (2001)**, stated that the nurses believed that the anesthesiologist is considered the only responsible person about the patient's condition throughout the induction, maintenance and recovery from anesthesia. It also revealed that the nurses' knowledge and practices were unsatisfactory regarding assisting during induction of anesthesia.⁽³⁴⁾

With respect to nurses compliance with the principles of aseptic technique in wearing mask, scrubbing, gowning, gloving and draping the study showed that these practices were done correctly for approximately one half of patients. This can be justified by that the majority of nurses have no

attendance of training programs related to principles of aseptic technique and infection control; the newly assigned nurses had no orientation programs, no adequate supervision and absence of procedure guidelines manual to be followed by the nurses. It has been observed that the nurses did not scrubbing, did not follow the principles of aseptic technique during gowning and gloving in the operation of anorectal region because they believed that these areas are already contaminated. This result is incongruent with **Phillips (2004)**, who showed that the majority of nurses had complied well with gowning and gloving⁽³⁵⁾

Concerning practices such as preparing the mayo stand with necessary instruments and equipments, patient's skin preparation and safe handling of surgical instruments, this study clarified that these practices were done correctly for more than one half of patients. This finding may be related to the nurses' belief that these practices are the core of their work. Furthermore, it has been observed that the surgeon usually direct nurses before surgeries about their preferences of instruments.

Regarding monitoring of general anesthesia, the study showed that the majority of patients who received general anesthesia were monitored by the anesthesiologist not by the nurses. This finding may be due to shortage of the nursing staff, nurses' unsatisfactory nurses' awareness about anesthesia and its management that was supported by **John (2011)**,⁽³⁾. In addition, the nurses believe that their responsibilities related to anesthesia are only recording practices such as the administered anesthetic medications given to the patient, intravenous infusions, tubes and catheters attaches to the patient as well as the name of surgeon and anesthesiologist. This result is incongruent with **Rider (2003)**, who stated that the operating room nurse should monitor and record the patient's condition during the preoperative, intraoperative and postoperative phases.⁽³⁶⁾

As regards to safety practices during phase III (sign out) that includes practices such as oral reviewing of the surgical operation (patient's diagnosis, type of operation, presence of any complications, and any variation in the procedure), the study revealed that these practices were not done for the majority of patients. **The World Alliance for Patient Safety (2008)**, showed that these practices were not done for the majority of settings included in the study. It may be due to lack of knowledge and awareness about the importance of team oral reviewing of the patient's condition and miscommunication between the operating room personnel (surgeon, anesthesiologist and nurse).⁽¹⁾

This finding is supported by the **Agency of Healthcare Research and quality** which found that

team oral reviewing of the patient condition is the most neglected safety practice in the operating theatres.⁽³⁷⁾ **Makary and Sexton (2007)**, stated that oral reviewing of the patient name, diagnosis and site of surgery are necessary for reducing the risk for wrong site surgery and improving the perceived collaboration among the operating room team.⁽³⁸⁾

Henderson and Devenport (2007), reported in their survey that communication, coordination and decision making roles between the surgical team are the direct ways for high quality and safe patient care. In this respect, **Lawson (2008)**, stated that continuous cooperation, communication and collaboration between the perioperative nurse, surgeon and anesthesia care providers are essential for each surgical patient's outcome. In this respect, **Canadian Nurse Association (2004)**, stated that nurses and other health care professionals recognize teamwork and the opportunity to practice collaboratively as important aspects of patient safety.⁽³⁹⁻⁴¹⁾

These results were congruent with **Abo Jash (2008)**, stated that ensuring patient's safety requires operational system and process that will maximize the likelihood for safety and prevent adverse medical events. In addition, safer health care is often delivered in a dynamic environment with complex interaction, communication and cooperation among patients, medical staff, infrastructure, equipments, policies and procedures.⁽⁴²⁾

It also may be related to lack of nurse's sense of creation and leadership due to their exposure to verbal abuse. This is in accordance with **Abdo (2011)**, stated that these effects have a major implication on nursing profession in a term of retention, satisfaction and quality of care.⁽⁴³⁾

Furthermore, practices concerning processing and safe handling of laboratory and tissue specimens in the present study were incorrectly done for the majority of patients. This can be related to lack of nurse's knowledge about different types of specimens, which requires different precautions to preserve such as solution used and type of container, in addition to lack of equipments such as safe specimens' containers. In this respect, the **WHO (2009)**, reported that safe handling of surgical specimens is one of the most important steps to be considered by the operating room nurse to prevent errors related to missing or mislabeling of specimens.⁽⁴⁴⁾

The Association of Surgical Technologists, stated that the nurse must be knowledgeable about the characteristics of safe specimens' containers that must be rigid, impermeable, unbreakable and non-reactive to fixative solutions and suitable to the size of specimens. Moreover, the containers must have a secure, tight cover and not transparent. In addition, these containers must have label containing patient's

full name, type and site of specimen, diagnosis and date of surgery.⁽⁴⁵⁾

As regards immediate post operative care, the study results showed that the care was done by the anesthesiologist for the majority of patients. These results can be related to the nurses' misbelieve that immediate post operative care is the responsibility of the anesthesiologist. Also, it may be due to shortage of staff, increased number of surgeries, and absence of policies and definite job description for the anesthesia nurse. In addition, during this period there were no facilities or place inside the operating room for immediate postoperative care. In this respect, **Barash (2009)**, state that immediate post operative period is considered a critical period for the patient who receives general anesthesia as complications may occur. Therefore, the anesthesia nurse must remain alert and available to assess the patient's level of consciousness, vital signs; tubes connected and assist in the management of any complications.⁽⁴⁶⁾

Moreover, the present study clarified that the practices related to care of surgical instruments such as cleaning, preparing for sterilization, and autoclaving were done correctly for the majority of patients in order to prevent cross infection except practices concerning disinfection of instruments. The study showed that these practices were not done for the majority of patients. This can be due to nurse's belief that disinfection of instruments must be done only for patients with blood born diseases such as hepatitis C+ve. In this respect, **The World Health Organization (2004)**, which revealed that these practices are not correctly done for the majority of patients involved in the study. **Williams (2003)**, stated that surgical site infection resulting from poor disinfection and sterilization of instruments remains the second most common type of nosocomial infections, accounting for approximately one third of all acquired infections.^(47,48)

In this regard **Spry (2005)**, stated that proper cleansing, disinfection and sterilization of contaminated objects significantly and often reduce microorganisms. Also, **Mangum (2001)**, indicated that failure to remove foreign materials from an object is likely to render disinfection and sterilization ineffectively.^(49,50)

The non compliance with disinfection and sterilization procedures detected in the presence study was incongruent with the results of **Pudner (2000)**, which indicated that the minority of nurses use infection control measures during cleaning, disinfection and sterilization of instruments and reflects these results to lack of in-service training programs for nurses related to infection control measures. Newly assigned nurses imitate the others

and there is no availability of standards and performance checklist related to care of instruments. ⁽⁹⁾

The same findings is also in line with **El-Genaidy (1993)**, **Abo-shadi and Ibrahim (2001)**, reported that nurses did not clean or sterilize instruments effectively and the performance of nurses was poor regarding cleaning and disinfection of instruments. ^(51,52)

Concerning practices related to post operative environmental hygiene, the study findings showed that these practices were done correctly for more than one half of patients. According to the study nurses perception they perform these practices as routine to be done at the end of the day and between patients. In addition, the operating theatre has a fixed weekly and monthly day for cleansing and disinfection of the operating room environment.

This result is congruent with the result of **Magnum (2001)**, who stated that proper cleansing reduces the amount of exogenous microorganisms in the surgical environment and helps to reduce air born contaminants that may travel in dust and settle on surfaces. Also, well developed cleansing protocol should be implemented for all surgical procedures for protection of both patient and staff. ⁽⁵⁰⁾

Concerning the relation between patients age group, presence of patient's associated diseases, nurses years of experience, nurses attendance of training programs and their relation with nurses' level of practice, the study revealed that the nurses practices was not affected by any of these factors. It may be related to lack of nurses satisfaction by their work, nurses with long years of experience were not involved in direct patient care which led to shortage of staff, increased patients to nurses ratio, heavy workload on hospital nurses than ever due to four main reasons: increased demand for nurses, inadequate supply, reduced number of nursing staff and increased overtime.

These results were in contrast with **Khatab (2005)**, who found that nurses' level of practice was positively correlated with the availability of equipment and supplies, job satisfaction, personal and professional characteristics such as the nurses' years of experience. While these results were dissimilar with **El-kady (2010)**, revealed that the nurses years of experience and attendance of training programs have a positive effect on nurses performance. ^(53,54)

Daniel and France (2008), stated that the surgical team compliance with the perioperative safety practices is positively changed after crew resource management training. ⁽⁵⁵⁾

Increased patients to nurses' ratio increase the surgical patient risk for hazards and makes nurses more likely to experience burnout and job dissatisfaction. The lower the proportion of

professional nursing staff employed in the operating room, the higher the number of medical errors and wound infection, the less experienced nurse, the higher the percentage of wound infection. ⁽⁵⁶⁾

Alfredsdottir (2008), in his study about **Nursing and patient safety in the operating room** showed that work experience, communication and the organization of work are key factors in patient safety. In this respect, **Henrikson and et al (2008)** stated that there are two main factors affecting the intraoperative patient safety: communication breakdown and information loss. Furthermore, high workload and multiple competing tasks are important factors. ^(57,58)

According to the **WHO guidelines for safe surgery** potential standards for improvements involve four areas: safe surgical teams, by promoting communication among team members to ensure that each preparatory step is accomplished in a timely and adequate fashion with an emphasis on teamwork; safe anesthesia, by appropriate patient monitoring and advanced preparation to identify potentially lethal anesthetic or resuscitation problems before they cause irreversible harm; prevention of surgical site infection, through antisepsis and control of contamination at all levels of patient care; and measurement of surgical services, by creating public health metrics to measure provision and basic outcomes of surgical care. ⁽⁵⁹⁾

Conclusion

This study revealed that the nurses level of safety practices toward the general surgical patients were unsatisfactory along the three phases of surgery. There was no significant correlation between the nurses' level of safety practices and patient age, presence of patients associated diseases, nurse's years of experience or previous attendance of training programs in the majority of patients.

Recommendations

- In-service training programs for all operating room personnel.
- Develop a procedural manual specific to intraoperative surgical patient's safety in Arabic language.
- Collaborate with the operating department nursing authorities to find effective methods of staff mix and assignment in order to facilitate the work and overcome the shortage of staff.
- Increase the nurse's awareness about their vital role in the achievement of safe anesthesia and enhance their knowledge regarding the developed standards for intraoperative nursing interventions.
- Regular annual self appraisal for the operating room personnel for application of intraoperative patients' safety practices.

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