

General Nursing Measures Implemented For Control and Prevention of Nosocomial Infection In The General Operating Rooms

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Abstract: Today, There is an increasing concern worldwide to control and prevent acquired Infection .The incidence of nosocomial infection in the hospital environment ranges from 5% to 8%.which occurred by one in 20 patients admitted to the hospital.⁽¹⁾ It is estimated that 20% of these infections are contracted in an operating theatre with possible irreversible consequences for patients.⁽²⁾ Operating room departments are one of the high risk for nosocomial infection, it bears a surgery and an emergency treatment of patients for any surgery, so the high quality of nursing and surgical measures implemented to control and prevent infection are directly affect the prognosis of surgical patients and hospital recovery.⁽³⁾ Thus , the aim of the study is to determine the view of the operating room nurses, anesthesiologists and surgeons in general nursing measures implemented for control and prevention of nosocomial infection in the operating rooms The study was carried out in the general operating rooms of the main university hospital in Alexandria .The interview questionnaire sheet of all nursing measures implemented for prevention and control of infection in the operating rooms was used for data collection. The study revealed that the most of infection control activities were performed by operating room nurses during the intra operative period. Except between each operation, weekly cleaning and caring of physical environment, caring and cleaning of air condition filter were not performed by the majority nurses. So the nurse's must increase their awareness about their vital role in the prevention of infection in the operating room. Also, Nurses performance should be adequately supervised by qualified head nurses.

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1. Introduction

Nosocomial infection is a major problem requiring more attention than it presently receives. It notorious for the manner in which they complicate the course of the original illness ,increase costs of hospital stay , delay the recovery and increase morbidity and mortality in surgical ill patients.^(4,5)

Operating room department is one of the high risk for nosocomial infection development., it bears a surgery and emergency treatment of patients with the task for any surgery, the quality of their work directly affects the prognosis of surgical patients and hospital recovery outcomes.⁽³⁾ Furthermore, the initial introduction of microbial pathogens often occurs during the surgical procedure performed in the Operating Theatre .So the risk of nosocomial infection is present in all surgical procedures. As the Surgical site infections (SSIs) are considered the second to third most common site of health care associated infections (HAIs). The complications of surgical procedures cause considerable high morbidity and mortality when these occur deep at the site of the surgical procedures.⁽²⁻⁵⁾

As regards, infection control related factors, cross contamination play a major role in the spread of nasocomial pathogen due to laxity of the strict observance of safe procedural implementation by the

various health care team in Operating Theatre environment. It was also advanced that understaffing may be a contributing factor for nosocomial infections.⁽⁶⁻⁸⁾ when the surgical procedures turn over to operating room increase daily to the operating room nurses ratio must increase. The provision of infection control nursing measures such as surgical technique may decline with inadequate ratio of nurses.⁽⁹⁾

Sujun (2010) mentioned that, the source of operating room infection is categorized into six main groups:

- 1 - Air infected droplets in the air, dust may carry pathogens, which can directly enter the cut, or drop into the equipment, dressing, and polluted the incision. Moreover, The movement of the staff is the main reason for changes in the operating room bacteria which, leading to the increased mobility of air operations that increased chances of infection.
- 2- Surgical sterilization or disinfection of the misuse is not complete without the instrument, dressing, resulting in serious infection. Also, Intraoperative undetected expired disposable sterile items, damaged packaging, and equipments used during anesthesia as endotracheal intubation, ventilator tube, oxygen humidifier bottles which can be a

direct result of lax sterilization of pulmonary infection in patients.

- 3- Surgical hand scrubbing, gloving of the surgeon, scrub nurses hands' aren't standardized due to, the hand become an important source of bacteria. Furthermore, The surgeon and other staff skin exposure to dust and bacteria dander fall into the incision, Also, the patient's blood, sweat soaked clothes when the bacteria penetrating surgery will result in infection.
- 4 care operations such as blood transfusion, infusion, intravenous anesthesia strict aseptic medication can lead to infection.
- 5- dressing after surgery dirt equipment, the patient's blood, secretions, fluid handling is not complete, which can also cause infection in surgical patients.
- 6- Finally, the operating room cleaning is not strict hygiene, and after surgery is not complete terminal disinfection.⁽⁴⁾

Therefore, operating room nurses had an important role in control and prevention of developing nosocomial infection. Moreover, many 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.⁽¹⁰⁾

The association of operating room nurses (AORN) has developed nationally recognized standards that are considered the definitive basis of practice for operating room nurses. These include a number of specific recommended practice that provide the operating room nurse with a firm basis of practice for operating room nursing.⁽¹⁰⁾

All surgical patients 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 to control exposure to infection.^(8,9)

Before the surgery, the scrub nurse performs the following activities; wearing a mask, wearing disposable shoe cover and eye protection, performing surgical hand scrub, wearing a sterile gown, wearing sterile gloves, and assisting the surgeon in gowning and gloving.^(11,12) Setting up the sterile tables includes preparation of the mayo stand with basic sharp instruments, basic clamps, basic retractors and basic graspers, preparing sutures, ligatures and special instruments. Preparing back tables with additional supplies and instruments, sterile gowns and eye goggles, sterile gloves and needles, preparing ring

stand and operating room table and performing draping for all sterile tables in the sterile field.^(12,13)

Double checking the count of instruments, sharps, sponges, gauzes, dressing, sutures and needles of each sterile set up with the circulating nurse before the start of operation and before the wound closure is mandatory.⁽¹²⁾

When the patient reaches the operating room table, the scrub nurse assists in draping the patient, skin preparation, assists the surgeon and the surgical assistants during the surgical procedure by anticipating the required instruments, sponges, dressing, drains, and other equipments, replacing instruments on the mayo stand with others from the back table as the operation proceeds and keeps an accurate count of extra sponges, needles or instruments collected during the operation and ensures that these additional supplies and instruments were recorded by the circulating nurse. After the surgical procedure, she assists the surgeon in wound dressing, ensuring that the area around the dressing is clean and the patient's gown is clean and dry, removes the drapes from the patient and cover the patient with a clean sheet.^(12,14,15)

In addition, she has to maintain safety, integrity and efficiency of sterile field by observing scrubbed team members for breaks in sterile technique, and ensuring that noise and movement within the sterile field is kept to a minimum.^(16,17)

Also, the circulating nurse organizes and prepares the operating room before the start of surgical procedure, checks to see that the operating room equipment, devices are functioning properly, gathers supplies for surgical procedure and opens sterile supplies for the scrub nurse, counts sponges, sharps and instruments with the scrub nurse before incision is made, at the beginning of wound closure, and at the end of surgical procedure.^(12,18)

In addition, the circulating nurse assists surgical team in gowning and arranging equipments, safely helps in the transfer of the patient to the operating room table and position the patient according to the surface performance and procedure type. She has to take safety precautions as safety belt, securing arms and padding bony prominences, reassuring the patient and applying conductive pad to the patient if electrocautery is used.^(19,20)

Furthermore, the circulating nurse continuously monitors procedures for any break in aseptic techniques and anticipates needs of the team. She can open additional sterile supplies for the scrub nurse, handles surgical specimens by institutional policy, documents on perioperative nurse's notes, identify any potential environmental danger or stressful situation involving the patient, other operating team members or both. One of her essential duties is maintenance of communication link

between events and team members in the sterile field and persons who aren't in the operating room but who are concerned with the outcome of the surgical procedure (as family members, head nurse, chairmen of the operating room).^(21,22)

Moreover, the circulator must have the supervisory capability and teaching skills necessary to ensure maintenance of safe and therapeutic environment for the patient as she kindly provide assistance for activities of all learner inside the operating room.^(21,23)

While as intraoperative and post operative phase When the patient reaches the operating room table, the scrub nurse assists in draping the patient, skin preparation, assists the surgeon and the surgical assistants during the surgical procedure by anticipating the required instruments, sponges, dressing, drains, and other equipments, replacing instruments on the mayo stand with others from the back table as the operation proceeds and keeps an accurate count of extra sponges, needles or instruments collected during the operation and ensures that these additional supplies and instruments were recorded by the circulating nurse. After the surgical procedure, she assists the surgeon in wound dressing, ensuring that the area around the dressing is clean and the patient's gown is clean and dry, removes the drapes from the patient and cover the patient with a clean sheet.^(12,14,15)

In addition, she has to maintain safety, integrity and efficiency of sterile field by observing scrubbed team members for breaks in sterile technique, and ensuring that noise and movement within the sterile field is kept to a minimum.^(15,21)

Afterwards, the nurse assists in transferring the patient from the operating room table to the recovery trolley, removing her gloves and gown effectively, and aiding in cleaning of the operating room.⁽¹²⁾

Then, she provides care for the surgical instruments which includes; cleaning, inspection and testing of the surgical instruments after cleansing, disinfection, and preparing the instruments sets for sterilization.^(12,24)

On the other hand, the operating nurse can perform these guide lines to control exposure of nosocomial infection through awareness by the sound system, moreover, strengthen the sterile operating room is a sterile concept of the departments require a higher quality of nursing activities, according to characteristics of their work, improve various rules and regulations, and strict control of foreign officers burglary, must be in strict compliance with rules and regulations of the operating room forbidden to wear surgical clothing, shoes outside.⁽²⁵⁻²⁷⁾

Also, operating rooms air before and after surgery were disinfect daily, with 500 ~ 1 000 mg / L

effective chlorine disinfectant, then wipe the floor plane and the daily routine ultraviolet light exposure 2 times / day, each time 30 min ~ 1 h, wipe the surface every two weeks with ethanol cotton dust, in order to achieve disinfection's health day with a fixed week. All the indoor, walls, doors and windows cleaned, with 0.2% peracetic acid spray ground.⁽²⁸⁾ Moreover, Air cultured were done monthly, finally avoid unnecessary movement of persons in operating room, to minimize the spread of dust, in the production of surgical dressings, or order within a wrapper.

As regards, surgical instruments, and medical supplies the steam sterilization can be used in principle, which should first pressure, it is highly efficient, fast, convenient, economic, security and many other advantages that can not be high temperature, humidity articles Cold sterilization is used. Moreover, the nurse ensures that the sterile cavity found within the mist, must be re-sterilized. External surgical instruments should be prepared to cleaning, disinfection, sterilization, after passing the discharge into the operating room for use. prior to use disposable sterile items should carefully review the validity of the packaging is sealed, the availability of moisture, cracking, contamination, failure can not use . then, patients during the operation had oxygen equipment, a variety of intubation device, breathing machine screw tube, face mask, air bags, dental pad, tongue forceps, etc., should be cleaned after use and disinfected with a disinfectant to do one, repeated use is strictly prohibited without sterilization, and improve cycle disinfection system, especially for infrequently used rescue equipment to be disinfected regularly to prepare for emergency use in safety. various operations to comply with the principles of aseptic technique to prevent contamination.^(12,27)

Furthermore, persons hand surgery hand disinfection measures to control infection is to control one of the most important measures of nosocomial infection, surgical personnel should strictly enforce the effective hand-scrubbing system, the hand-washing process at least 5 min, higher than the elbow to keep their hands to avoid contamination. Hands and forearm brushing is completed, rinse clean, sterile towel until dry or dry naturally, the disinfectant 3 ~ 5 ml rubbed on the hands and forearms, 1 min after the wear sterile surgical gowns, wearing sterile surgical gloves in order to participate, monthly monitoring to ensure that staff do not exceed the number of fingers contaminated 5cfu/m². Dirts treatment after surgery showed be follow as, non-infected surgical instruments with 1 000 mg / L chlorine disinfectant rinse with water after 30 min, dry oil reserve. Dirt bucket, attract dirt bottle with 1 000 mg / L chlorine disinfectant After 30 min

immersion dumping, cloth laundry room treatment, surface water clean the operating room.^(7,24)

Also, for infected diseases as hepatitis and tuberculosis, preoperatively, the nurse must use peracetic acid and chlorine for disinfection the environment and equipments for those patients by prepare 0.2% peracetic acid solution, and placed in the operating room for anesthesiologists, nurses, tour operation to patients before and after hand washing. Use of operating room door shop a saturated solution of 0.5% peracetic acid cloth, to reduce staff cross-infection. Devices must be disinfected with 1 200 ~ 5 000 mg / L chlorine disinfectant solution or 0.5% peracetic acid solution, Then it should be rinsed after 30 min soaking, dried, packaged, and all things, especially with surgical instruments. Moreover, treatment should be strictly sterilized - cleaning - disinfection principle, cloth wrap, sprinkled disinfectant, indicating infection of surgery, laundry room treatment operating table, shadowless lamp, equipment vehicles, such ground may be the same concentration of indoor-use wipe. In relation to the indoor air one of these three can be used: extension of ultraviolet light exposure time, or high-intensity ultraviolet light exposure, and or peracetic acid fumigation, which calculated by 0.5 ~ 1 g/m³, and 15% diluted solution, heating evaporation, closed 2 h. can be used. Furthermore, surgical cloth items must be effective after immersion disinfection or cleaning a single tight package deal with evacuation pressure steam laundry washing, dressing, gloves, burning, drainage of fluid, fluid 2 000 mg / L chlorine disinfectant effect after 30 ~ 60 min into the sewer, indoor air treatment above.^(10,28)

In summary, the operating room nurses have an important role to play in the care of patients undergoing general surgery, this beneficial role will not be achieved unless these nurses follow professionalism

A locally written standard of Intraoperative nursing interventions for general surgery must be established as a step for effective prevention and control of Intraoperative and postoperative nosocomial infection complications. According to - Blais nursing practice act, (1997), standards of care are the legal guidelines for nursing practice. Nursing standards of care are defined in nurse practice act and by the state board of nursing of each state, by the federal and state laws regulating hospitals, by the professional and specially nursing organizations and by the written policies and procedures.⁽²⁹⁾

Manson, (2002) defines the standard as what the nurse experts testify that standards to be and ultimately what the juror believes. Gadery, United States, (2003) states that institutional policies and procedures must conform to state and federal laws, as well as community standards, and can't conflict with legal guidelines that define acceptable standards of

care.^(86,8) Standards are authoritative statements that describe a level of care or performance common to the profession of nursing by which the quality of nursing practice can be judged. These are general statements that address the broad scope of nursing practice.^(30,31)

2- Material and Methods

Material

Research design

A descriptive study research design was used to determine views and opinions of the operating room nurses, anesthesiologists and surgeons in general nursing measures implemented for control and prevention of nosocomial infection in the operating rooms.

Setting

The study was carried out in the general operating rooms of the main university hospital in Alexandria.

The operating rooms of the main university hospital included operating room "A" which specialized in chest and heart surgeries, operating room "B" which specialized in surgeries of digestive system, operating room "C" which specialized in plastic surgeries, neurosurgical operations and urosurgical operations.

Subjects

The subjects of this study comprised of all operating room nurses, surgeons and anesthesiologists who were assigned for the management of intraoperative patients undergoing general anesthesia in the above mentioned setting to determine their opinions in the nursing measures implemented for control and prevention of nosocomial infection in the operating rooms.

The total numbers of nurses were 50 nurses who have a diploma of nursing secondary school while the total number of surgeons and anesthesiologists were 50. They were divided as following:

- A- Nurses; (10) nurse from each of the above mentioned setting.
- B- Physicians (surgeons and anesthesiologists), the total number were 50 from the previous mentioned setting.

Tools

Three tools were developed by the researcher to collect the necessary data for this study.

Tool I

An interview questionnaire sheet based on the review of current related literature and an international standard for prevention of nosocomial infection was developed by the researcher to determine the operating room nurses', surgeons', and anesthesiologists' views about the general nursing measures implemented for prevention and control of

infection in the operating rooms. The interview questionnaire sheet included two parts:

Part I:

Included items related to sociodemographic data of the studied subjects such as name, age, education, position, qualifications, years of experience and previous attendance of training programs related to infection control.

Part II:

Included all nursing measures implemented for prevention and control of infection in the operating rooms containing (63) items such as practices related to the use of the principle of aseptic techniques, handling sharps, managing significant exposure and environmental hygiene.

Also, this part included items related to care, cleaning and decontamination of the furniture, overhead operating light, anesthesia equipment, floors and walls.

In addition, items related to daily terminal cleaning and weekly or monthly cleaning.

Tool II

A checklist for assessment of the availability of material resources required for control and prevention of nosocomial infection was developed by the researcher after reviewing the current related national and international literature. It was comprised of items related to:

Part I: this part included items related to supplies required for operating room attire as masks, sterile gowns, sterile gloves and overhead.

Part II: included items related to supplies required for hand decontamination, surgical instruments (cleaning, disinfection and sterilization), equipment decontamination and supplies needed for environmental hygiene.

This tool was collected from the head nurses of the above mentioned setting who were responsible for requirement of supplies.

Tool III

A checklist for assessment of the operating room physical design. It included items related to the presence of red lines, ventilation systems, reception areas, autoclaves and adequacy of scrubrooms and environmental aerations.

Methods

- 1- Permission to carry out the study was obtained from the responsible authorities of the Alexandria Main University Hospital after providing an explanation of the aim of the study.
- 2- The structured interview (tool I) was developed by the researcher based on the reviewing of pertinent literature and the routine nursing care

which implemented for prevention of infection in the operating rooms.

- 3- Tool (II), (III) was also developed by the researcher to investigate the availability of the material resources and physical design needed for the prevention and control of infection in the operating rooms.
- 4- The tools were revised by 5 experts in the nursing and medical field to test the tools for content validity, completeness, and the clarity of the items. Accordingly, all necessary modifications were done.
- 5- Tools were tested for its reliability using Cronbach-Alpha coefficient statistical test.
- 6- A pilot study was conducted on 5 nurses and surgeons to test tool (I) for clarity and practicability of activities included for prevention of infection in the operating rooms.
- 7- The investigator explained the purpose of the study to the operating room nurses and surgeons included in the study.
- 8- Nurses' and surgeons' formal consent to participate in the study were obtained.
- 9- The participating operating room nurses and surgeons were interviewed by "tool I" to determine their opinions regarding nursing measures implemented for control and prevention of infection in the operating rooms.
- 10- Tools (II) and (III) were used to investigate the availability of material resources and physical designs needed for prevention of nosocomial infection and collected from the nurses who were responsible for material resources in the previously mentioned setting.
- 11- The physical design was observed by the investigator in the previous settings using tool (III).
- 12- The data obtained are collected and tabulated using appropriate statistical analysis.
- 13- The data was collected during a period of 6 months.

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).
- Numbers and percents were used for presenting qualitative variables.
- A score > 65% was considered satisfactory.
- A score ≤ 65% was considered unsatisfactory.

3. Results

The study was done in order to assess the general nursing measures implemented for prevention of infection in the operating rooms. The results are presented as follows:

Part I:

Results related to socio demographic characteristics of operating room nurses and physicians.

Part II:

Results related to operating room nurses', physicians' views and opinions related to general nursing measures implemented for prevention of infection in general operating rooms.

Part III:

Results related to the availability of material resources for prevention and control of infection in the operating rooms.

Part IV:

Results related to operating room design available for prevention of infection.

Table (1): Shows the distribution of nurses and physicians according to their socio demographic characteristics:

The study revealed that all nurses had diploma of nursing secondary school and 40% of nurses had years of experience less than 20 years.

Also, this table showed that the majority of nurses not attend training programs related to infection control, while the majority of physicians attend training programs related to infection control.

Table (2): Shows nurses and physicians opinion regarding use the principle of aseptic technique and managing significant exposure during surgery.

This table revealed that practices related to check that contaminated items removed immediately from sterile field, face the sterile field at all times, avoid activities that create air currents and remove wet material from the sterile field were not done by (96%, 52%, 64% and 80%) of operating room nurses respectively. While as, these results indicated that handling sharps and managing significant exposure were done by the majority of nurses more than 90% of nurses in most of activities except avoid recapping of used needles were done by 20% of nurses.

Table (3): Presents nurses' and physicians' opinion regarding the role of the nurse in environmental hygiene.

It was noticed that most of activities performed by more than 95% of nurses regarding ensures a safe and effective environment for the delivery of nursing care and dispose sharp items safely.

Also, it was found that activities as roll drapes off the patient and placed it in disposable plastic bag was viewed as performed by 44% of nurses only.

Table (4): Reveals nurses' and physicians' opinions regarding the role of the nurse in caring of

equipments and physical environment (daily, between operation).

This table revealed that practices concerning care, cleaning and disinfection of furniture, overhead operating light, anesthesia equipment, laundry, trash, floors and walls were performed by more than 85% of nurses daily(at the end of the day) except caring of the overhead operating light performed by 36% of nurses only.

Moreover, this table showed that 100% of nurses not perform these activities between operations. Also, the results indicated that the activities as cover the carts or close it and get the room ready for the next patient in an average time 15-20 minutes not performed by 88% of nurses for each of these activities.

Table (5): Portrays nurses' and physicians' opinion regarding the role of the nurse in daily, weekly and monthly cleaning of physical environment.

The results revealed that the majority of nurses were done the most of the daily activities, while 24%of nurses were clean cabinets and doors around the handles. Also, this table showed that 100% of nurses were not perform activities related to cleaning of the Air intake grills, ducts and filter covers.

In addition, it was found that 100 %of nurses were not cleaning of physical environment weekly. While, this table showed that 100% of nurses performed activities related to monthly cleaning of physical environment except air condition vacuumed performed only by 8% of nurses.

Table (6): show the adequacy of material and supplies required for operating room attire.

It was found that goggles and gowns weren't found in the studied operating room by 100% ,40% respectively while most of supplies were present.

Table (7): Presents adequacy of material and supplies for hand, surgical instrument and equipment decontamination and environmental hygiene.

The study revealed that all supplies required are present in all studied operating room areas (more than 80%) except antimicrobial soap and drying sterile towel were found in 60%,40% respectively in the studied operating room areas.

Table (8): shows the areas and equipment in the physical design of the studied operating room areas required for infection control.

It was found that more than two third of the studied operating room were had swing doors, red lines, washing machine and utility room, although the post anesthesia care (PACU) unit were not present in any operating theatre. In addition, The results indicated that microbiological air sampling and test, replace fine air filters regularly present in 60% of the operating room areas.

Table (9): Describes the adequacy of the operating room areas and facilities required for infection control.

It was found that presence of adequate scrub room for each operating room present in 20% of the studied operating room only while other areas and facilities were present adequately in more than 80% of the studied operating room area.

4. Discussion

Advances in surgery concern to prevent acquired hospital infection through apply high quality of infection control in the operating rooms which affect on the out comes of surgical procedures. New surgical procedures and updated concepts of patient care have been a challenge that should be met well by the operating room nurse. So, She must be fully aware of these advances in care and, indeed, play a vital role with success.^(1,2,32,33)

In the present study all nurses had diploma of nursing secondary school and the minority of nurses had from 15 to less than 20 years of experience. Also, the majority of them not attend any patient safety or infection control training programs, while the majority of physicians attend training programs related to infection control. This finding agreed with Judith (2003), Saad (2007) who illustrated that the educational programs and years of experience for operating nurse affect in the quality of care delivery for surgical patients^(32,34)

Table (1): Distribution of nurses and physicians according to their socio-demographic data characteristics

	No	%
Education		
Nurse (diploma)	50	50.0
Doctors (master and doctoral)	50	50.0
Position		
Scrub nurse	25	25.0
Circulating nurse	25	25.0
Surgeons	25	25.0
Anesthesiologist	25	25.0
Hospital		
Main university hospital	100	100.0
Operating theatre		
A	20	20.0
B	20	20.0
C	20	20.0
Neurosurgical operation	20	20.0
Urosurgical operation	20	20.0
Years of experience		
<5	8	8.0
5 – 10	20	20.0
11 - 20	32	32.0
>20	40	40.0
Min. – Max.	3.0 – 35.0	
Mean ± SD	19.48 ± 11.37	
Previous attendance of training programs		
Physicians		
Yes	50	100.0
No	0	0.0
Nurses		
Yes	10	20.0
No	40	80.0

Table (2): Nurse's and physician opinion regarding use the principle of aseptic technique and managing significant exposure during surgery

	No		Yes	
	No	%	No	%
The principle of aseptic techniques				
Check sterility indicators of all sterile items.	0	0.0	100	100.0
Check that contaminated items should be removed immediately from the sterile field.	96	96.0	4	4.0
Sterile team must be properly attired	0	0.0	100	100.0
Identify work restriction area.	4	4.0	96	96.0
Sterile team members motion should be from sterile to unsterile.	12	12.0	88	88.0
Avoid reaching over sterile field.	20	20.0	80	80.0
Avoid coughing and sneezing near a sterile field.	8	8.0	92	92.0
Hold sterile object above waist level.	12	12.0	88	88.0
Face the sterile field at all times.	52	52.0	48	48.0
Avoid activities that create air currents.	64	64.0	36	36.0
Remove wet material from the sterile field.	80	80.0	20	20.0
Handling sharps				
Avoid bending or breaking or manipulating used sharps.	0	0.0	100	100.0
Avoid recapping used needles.	80	80.0	20	20.0
Use all disposable sharps once only.	0	0.0	100.0	100.0
Use extreme caution when:				
Handling sharp instrument after procedure.	0	0.0	100	100.0
Cleaning reusable sharp contaminated with blood or body fluids.	0	0.0	100	100.0
Handle sharps from the point of use.	0	0.0	100	100.0
Managing sharps injury/needle stick injury.				
Check that the site of injury is immediately washed after needle stike. With soap and water.	4	4.0	96	96.0
Disinfect the site of injury with alcohol 70% by rubbing vigorously and moving from the center out ward.	0	0.0	100	100.0
Cover the site of injury with dressing.	8	8.0	92	92.0
Managing splashes of blood or bloody fluids on mucous membrane or non intact skin.				
Check that the area is irrigated with sterile saline or running water for 2 minutes.	4	4.0	96	96.0
Report the incident to the head nurse immediately noting the name of the patient.	8	8.0	92	92.0

Table (3): Nurse's and physician opinion regarding the role of the nurse in maintain environmental hygiene.

	No		Yes	
	No	%	No	%
Ensure a safe and effective environment for the delivery of nursing care				
Roll drapes off the patient and placed it in disposable plastic bag.	56	56.0	44	44.0
Discard solided sponges, other bloody waste, and disposable items in appropriate biohazard waste receptacles.	0	0.0	100	100.0
Discard uncised sponges, non woven drapes and other non bloody disposable waste into the trash.	0	0.0	100	100.0
Dispose of sharp item safely.				
Remove knife blades from handles.	0	0.0	100	100.0
Place reusable surgical needles either on a needle rack or loose, into a perforated stainless steel box.	0	0.0	100	100.0
Place reusable needles used for injection or aspiration in a perforated stainless steel box.	4	4.0	96	96.0
Remove blood, tissue, bone and other gross debris from instrument (instrumental cleaning, disinfection and sterilization).	4	4.0	96	96.0
Suction detergent disinfectant solution through the lumen of reusable suction tips.	0	0.0	100	100.0
Discard disposable suction tips.	4	4.0	96	96.0
Dispose of solutions and suction bottle content in a flushing hopper connected to a sanitary sewer.	4	4.0	96	96.0
Rinse the container, plunger and lid of wall suction.	0	0.0	100	100.0
Sterilize reusable glass suction container.	4	4.0	96	96.0
Carts system clean up				
Put all reusable instruments, basins, supplies and equipment including suction bottle inside the cart.	4	4.0	96	96.0
Cover the cart or close it.	88	88.0	12	12.0
Take the cart throw the central decontamination area outside the OR suite.	16	16.0	84	84.0
Remove the cart from the OR suite via the outer corridor.	4	4.0	96	96.0
Get the room ready for the next patient in an average time 15-20 minutes.	88	88.0	12	12.0

Table (4): Nurse's and physician opinion regarding the role of the nurse in caring, cleaning of equipments and physical environmental (daily, between operations)

	No		Yes	
	No	%	No	%
Daily				
Furniture	0	0.0	100	100.0
Over head operating light	64	64.0	36	36.0
Anesthesia equipment	12	12.0	88	88.0
Laundry	8	8.0	92	92.0
Trash	12	12.0	88	88.0
Floors	8	8.0	92	92.0
Walls	8	8.0	92	92.0
Between operation				
Furniture	100	100.0	0	0.0
Over head operating light	100	100.0	0	0.0
Anesthesia equipment	100	100.0	0	0.0
Laundry	100	100.0	0	0.0
Trash	100	100.0	0	0.0
Floors	100	100.0	0	0.0
Walls	100	100.0	0	0.0
Carts system clean up				
Put all reusable instruments, basins, supplies and equipment including suction bottle inside the cart.	4	4.0	96	96.0
Cover the cart or close it.	88	88.0	12	12.0
Take the cart throw the central decontamination area outside the OR suite.	16	16.0	84	84.0
Remove the cart from the OR suite via the outer corridor.	4	4.0	96	96.0
Get the room ready for the next patient in an average time 15-20 minutes.	88	88.0	12	12.0

Table (5): Nurse's and physician opinion regarding the role of the nurse in daily, weekly and monthly cleaning of the physical environment

	No		Yes	
	No	%	No	%
Daily terminal cleaning				
Scrub all furniture using mechanical friction and chemical disinfectant solution.	4	4.0	96	96.0
Wash automatically stretchers, tables and then steam cleans and dries them.	8	8.0	92	92.0
Clean equipment such as lasers, ECG, other monitors with care not to saturate surfaces to the degree that disinfectant solution runs into the mechanism.	0	0.0	100	100.0
Clean and disinfect kick buckets, launder hamper frames and other waste receptacles (sterilize when feasible).	4	4.0	96	96.0
Clean the floor daily.	0	0.0	100	100.0
Check walls and ceilings for soil sports and clean as necessary.	40	40.0	60	60.0
Clean cabinets and door especially around handles with disinfectant solution.	76	76.0	24	24.0
Air intake grills, ducts and filter covers should be cleaned.	100	100.0	0	0.0
Weekly cleaning				

Clean the walls when they become visibly solided.	100	100.0	0	0.0
Wash the ceiling with special care for the ceiling mounts, tracks and lighting fixtures.	100	100.0	0	0.0
Machine scrub the suite periodically to remove accumulated deposits.	100	100.0	0	0.0
The exterior of air conditioning grills should be vacuummed at least weekly.	100	100.0	0	0.0
Change the filters on an off shift or on the week end.	100	100.0	0	0.0
Clean all types of sterilizers regularly and tested as recommended.	100	100.0	0	0.0
Monthly cleaning				
Clean the walls when they become visibly solided.	0	0.0	100	100.0
Wash the ceiling with special care for the ceiling mounts, tracks and lighting fixtures.	0	0.0	100	100.0
Machine scrub the suite periodically to remove accumulated deposits.	4	4.0	96	96.0
The exterior of air conditioning grills should be vacuummed at least weekly.	92	92.0	8	8.0
Change the filters on an off shift or on the week end.	0	0.0	100	100.0
Clean all types of sterilizers regularly and tested as recommended.	0	0.0	100	100.0

Table (6): Description of adequacy of supplies required for operating room attire

	No		Yes	
	No	%	No	%
Adequacy of supplies for attire				
Masks	0	0.0	5	100.0
Goggles	5	100.0	0	0.0
Gowns	2	40.0	3	60.0
Gloves	1	20.0	4	80.0
Over head	0	0.0	5	100.0

Table (7):Description of adequacy of supplies required for operating room hand, instruments, equipment decontamination and Environmental hygiene in different operating room areas

	No		Yes	
	No	%	No	%
Hand decontamination				
Betadine	0	0.0	5	100.0
Antimicrobial soap	2	40.0	3	60.0
Drying sterile towels	1	20.0	4	80.0
Surgical instruments				
Cleaning agents	0	0.0	5	100.0
Disinfectants agents	0	0.0	5	100.0
Wrapper	0	0.0	5	100.0
Sterilizing indicators	0	0.0	5	100.0
Equipment decontamination				
Anesthesia machine	1	20.0	4	80.0
Ventilator circuits of anesthesia machine	1	20.0	4	80.0
Suction container	1	20.0	4	80.0
Suction tubes	1	20.0	4	80.0
Oxygen humidifier	1	20.0	4	80.0
Oxygen delivery face mask	1	20.0	4	80.0
Nasal cannula	1	20.0	4	80.0
Ambo bag	1	20.0	4	80.0
Laryngoscope blade	1	20.0	4	80.0
Blood pressure cuff	1	20.0	4	80.0
Operating room tables	1	20.0	4	80.0
Back table	1	20.0	4	80.0
My stand	1	20.0	4	80.0
Ring stand	1	20.0	4	80.0
Kick bucket	1	20.0	4	80.0
Spot light	1	20.0	4	80.0
Diathermy	1	20.0	4	80.0
Lift or stand	1	20.0	4	80.0
Environmental hygiene				
Floor	0	0.0	5	100.0
Wall	0	0.0	5	100.0
Ceiling	0	0.0	5	100.0
Chairs	0	0.0	5	100.0
Nursing rooms	0	0.0	5	100.0
Nursing tables	0	0.0	5	100.0

Table (8): Shows the areas and equipment in the physical designs of the studied operating rooms required for infection control

	No		Yes	
	No	%	No	%
Operating rooms separated from general traffic	2	40.0	3	60.0
Presence of clean zones from the entrance to the operating	4	80.0	1	20.0
Provide safe easy movement of the staff	1	20.0	4	80.0
Provide ways for removal of dirty material	1	20.0	4	80.0
Ventilation system provide flow of air	1	20.0	4	80.0
Presence of standard ventilation for congenital operating theaters				
Microbiological air sampling and tests	2	40.0	3	60.0
Replace fine air filters regularly	2	40.0	3	60.0
Control of temperature and humidity	0	0.0	5	100.0
Maintain air condition and humidification	0	0.0	5	100.0
Swing doors	1	20.0	4	80.0
Reception areas	4	80.0	1	20.0
Dressing rooms	2	40.0	3	60.0
Red lines	1	20.0	4	80.0
Utility rooms	1	20.0	4	80.0
Auto claves	0	0.0	5	100.0
Washing machine	1	20.0	4	80.0
Post anesthesia care unit (PACU)	4	80.0	1	20.0
Operating rooms located	0	0.0	5	100.0
Sterilizing room windows open	0	0.0	5	100.0
Auto claves	0	0.0	5	100.0
Electrical equipment maintained	0	0.0	5	100.0
Presence not via the main sterile area	1	20.0	4	80.0
Large sink	3	60.0	2	40.0
Laundry carts or hampers	1	20.0	4	80.0
Washing machine	1	20.0	4	80.0

Table (9):Describes the adequacy of the operating room area and facilities required for infection control

	No		Yes	
	No	%	No	%
Scrub room for each operating room	4	80.0	1	20.0
Scrub facilities (sinks)	0	0.0	5	100.0
Environmental aeration (theatre)	0	0.0	5	100.0
Presence of clean utility has the following:				
Easily accessible	0	0.0	5	100.0
Wide room access	0	0.0	5	100.0
Separate from dirty utility	1	20.0	4	80.0
Clean utility contain:				
Sink	1	20.0	4	80.0
Refrigerator	1	20.0	4	80.0
Storage space	1	20.0	4	80.0

Used for storage of	0	0.0	5	100.0
Clean equipment	0	0.0	5	100.0
Old electrical equipment	0	0.0	5	100.0
Anesthesia supplies	0	0.0	5	100.0

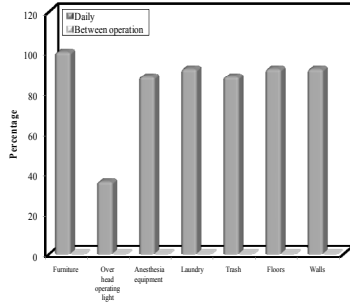


Figure (1): Nurse’s and physician opinion regarding the role equipments and physical environmental (daily, between operation)

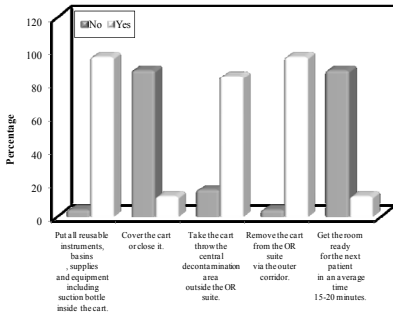


Figure (2): Nurse’s and physician opinion regarding the role of the nurse

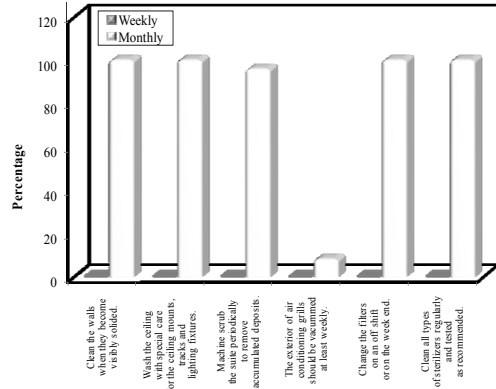


Figure (3): Nurse’s and physician opinion regarding the role of the nurse in weekly or monthly cleaning of the physical environment

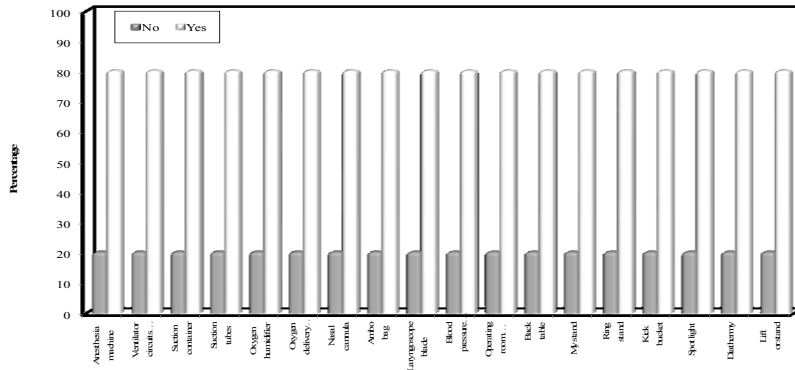


Figure (4): Description of adequacy of supplies for supplies for decontamination in different operating rooms

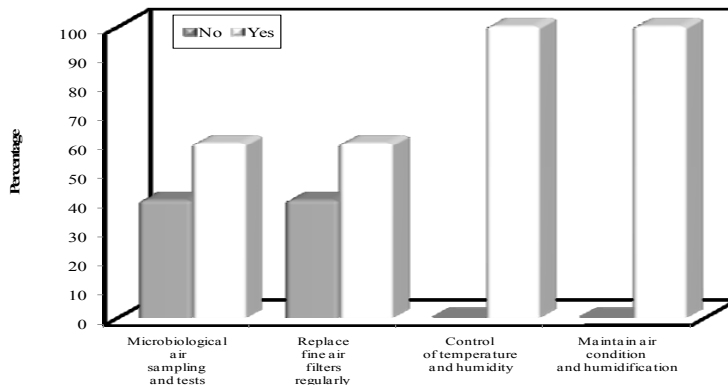


Figure (5): Show the presence of standard ventilation for congenital operating theatres

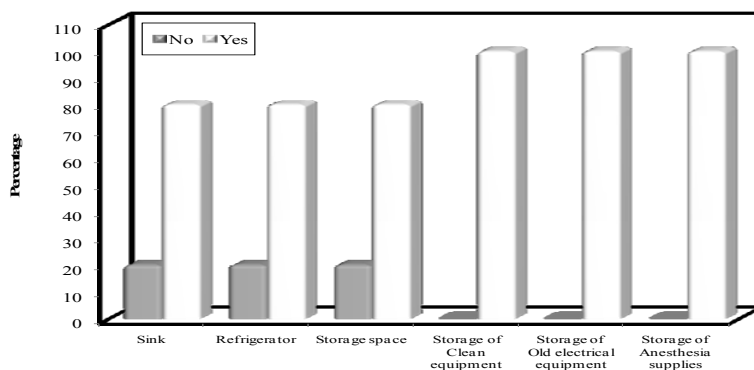


Figure (6): Describes the adequacy of the operating room area and facilities required for infection control

Regarding use the principle of aseptic technique during surgery

The present study showed that the majority of the studied patients weren't removed contaminated items immediately from the sterile field, this is may be due to the shortage of the staff, there is an increase in the turn of the patient and there is no policy or standard performance check list applied in hospitals. Huston (2000) stated that proper cleansing, disinfection and sterilization of contaminated objects significantly reduce and often eliminate microorganisms.⁽²⁸⁾ Also, Mangum (2001) indicated that failure to remove foreign material from an object immediately is likely to render disinfection or sterilization ineffective.⁽³⁵⁾

In relation to environmental hygiene and handling contaminated drapes & equipment, the findings of the present study revealed that about half of the nurses weren't perform activities related roll drapes off the patient and placed it in disposable plastic bag. The results of this study are in agreement with the results of Bahgat (1999) who stated that the majority of nurses have poor knowledge and performance about handling contaminated equipment.⁽³⁷⁾ However, this result isn't in line with the finding reported by Sujun (2010) which revealed that knowledge of nurses regarding handling non disposable contaminated equipment was very good.⁽⁴⁾

Regarding caring of equipment and physical environment (daily, between operation), the study revealed that, the majority of the studied nurses weren't caring the equipments or hygiene of the environmental operating rooms between the operation. It may be due to unawareness of nurses about the importance of hygiene or shortage of the staff and increase in turn of the patient While this finding contradicting by Saad(2007) who stated that the majority of the operating rooms agreed about environments safety competencies between operation. Moreover, Burden (1993) illustrated that

maintaining environmental safety is important in all phases of surgical experiences, and he identified the particularly important area of safety in the intraoperative phase to be; mechanical safety, electrical safety, chemical safety, radiational safety, patient transportation and position safety, and continuous asepsis, which should be maintained by the circulating nurse in all phases of caring for patients undergoing general surgery.^(34,10)

In relation to the timing of cleansing physical environment in studied operating room the results of present study revealed that, the all nurses were not cleaning of physical environment weekly. This finding appears to be due to that nurses' intern believes about the importance of cleaning and disinfection of surgical environment in reducing and eliminating the spread of infection. In addition, the operating room theatres have a fixed monthly day for cleaning & disinfection of the operating room environment beside weekly and daily cleaning. Although they had no standards or written cleaning protocols.

Although the material and supplies attire required for operating room should be properly attired for surgery the results of present study revealed that, that goggles and gowns weren't found in the studied operating room by 100% ,40% respectively while most of supplies are present. This results is due to the fact that there was insufficient amount of goggles and gowns in the operating theatre, Similar results were found by Ahmed (1996) who showed that there was inadequacy of protecting clothing in operating theater⁽³⁹⁾

In addition, Mangum (2001) indicated that single disposable high filtration surgical masks sterile gowns should be worn by scrubbed persons in restricted surgical environment where sterile supplies may be located should be changed between procedures, or immediately if they become soiled.⁽³⁵⁾

Regards the material and supplies for hand, surgical instrument and equipment decontamination and environmental hygiene. The result of the present study showed that, all supplies required are present in all studied operating room areas except antimicrobial soap and drying sterile towel. These result contra dictating with Cameron (2007) who found that the important of maintaining the operating room bacteriological and chemical safety through scrub technique using soap and water was used for the first scrub using count method, then the subsequent scrubs could be replaced by an alcohol rub and he recommended from his research study that the traditional scrub after first scrub should be replaced by 70% isopropyl alcohol rub and presterilized brushes. And the importance of the presence of using dry sterile towel in prevent growth of micro organism and control infection. Moreover, Larson study and APIC committee (1995) found high skin damage and increased microbial counts with prolonged brush scrub. The study also showed advantages of alcohol based formulations that contain emollients and moisturizers for over all protection of the skin and suggests superiority in efficiency of alcohol products when compared with povidine-iodine which is used in Egyptian operating rooms as topical antimicrobial for surgical hands scrub.^(33,41)

Relation to the areas, facilities and equipment in the physical design of the studied operating room areas required for infection control. The results of the study showed that the post anesthesia care (PACU) unit were not present in any operating theatre these result contradicting by Cameron(2007), Mangum (2001) who stated that the surgical patients must transfer to anesthesia unit after surgery within the operating theater and apply anesthesia care until recovery by the anesthesia nurse^(33,35). Also these result of the present study were revealed that presence of adequate scrub room for each operating room present in 20% of the studied operating room. These result contradicting with Saad(2007) who stressed that ,hand surgery hand disinfection measures to control infection is to control one of the most important measures of nosocomial infection in operating theater , surgical personnel should strictly enforce the effective hand-scrubbing system in the scrub room.⁽³⁴⁾

Furthermore, Fortunato (2000) indicated that every patient undergoing general surgery has the right to receive the same degree of safety in the environment. Therefore, the routine clean up procedure can be accomplished by the circulating nurse and the scrub nurse working

cooperatively.⁽³⁸⁾ Finally the present study recommended to apply standard of infection control in the operating theater and the nurse must be aware about the importance of proper technique for hand scrubbing, service training programs for nurses and specific policies, procedure manual or posters for surgical hand scrubbing.^(10,42)

5. Conclusion

The study revealed that the majority of operating room nurses and physicians (surgeons and anesthesiologists) showed that the most of infection control activities performed by operating room nurses during the intra operative period.

Furthermore, these results showed that the minority of nurses were perform activities such as check that contaminated items removed immediately from sterile field, face sterile field at all times. Avoid activities that create air current, remove wet material from sterile field were done by

Moreover, activities for prevention and control of infection between each operation, weekly cleaning of physical environment and caring, cleaning of air condition filter were not performed by 100% of nurses.

Recommendations

1. In service education, refresher courses and training program on infection control measures should be regularly conducted for all operating room nurses.
2. Continuous surveillance of nosocomial infection in the operating rooms.
3. Posters should be posted in the operating room area to remind nurses for the need to comply with universal precautions for infection control in the operating rooms.
4. Continuous availability of personal protective equipment and adequate training for its proper use are essential.
5. Nurses performance should be adequately supervised by qualified head nurses.
6. Collaborate with the operating room department nursing authorities to find effective methods of staff mix and assignment in order to facilitate the work for prevention of infection and overcome the shortage of the staff.
7. Increase the nurse's awareness about their vital role in the prevention of infection in the operating room.
8. A manual of procedures for infection control as well as written policies for prevention of infection should be available to all health team working in the operating room.
9. Developed standard for prevention of infection should be available to all health team.

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