Summer Training at
Max Super Sepecialty Hospital, Saket, New Delhi
(April 3 to June 2, 2017)

Compliance with Infection Control Practices in Operation Theatre Complex

By
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MBA Hospital & Health Management
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INSTITUTE OF HEALTH
MANAGEMENT RESEARCH
(WHO Collaborating Centre for District Health System Based on Primary Health Care)

IIHMR UNIVERSITY

CERTIFICATE

This is to certify that Ms. **AMARJOT KAUR** has undergone summer training in **MAX SUPER SPECIALITY HOSPITAL, SAKET, NEW DELHI** from 3rd April to 2nd June 2017.

The candidate herself completed the project assign to her during summer training. Her approach to the project was sincere and proactive. This summer training is in partial fulfillment of the course requirement recommended for the award of MBA in Hospital and Health Management.

I wish her success in all her future endeavors.

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This is to certify that

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for a period of

3rd April 2017 to 2nd June 2017

at

Max Super Specialty Hospital,
Saket

"The Internship/Observership course is a Max certified course not affiliated to any National/International society".

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Dr. Shubnum Singh
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Max Healthcare, New Delhi

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I express my gratitude to college Dean **Dr. (Col.)Ashok Kaushik** for arranging the summer training in good schedule.

I hope that I can build upon the experience and knowledge that I have gained and make a valuable contribution towards this industry in coming future.

Sincerely,
Ms. Amarjot Kaur

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INTRODUCTION

Healthcare- Associated infection (HCAI) is one of the most common complications of health care management. It is a serious health hazard threatening the health and safety of patients and medical staff worldwide. These infections affect the quality of care as it leads to increased patients morbidity and mortality, length of hospital stay and the cost associated with hospital stay. Effective infection prevention and control is central to providing high quality health care to patients and a safe working environment for staff. This can be achieved by implementing good infection control programme.

OT is one of the "hot zones "of hospital for the emergence and spread of microbial infection. Good infection prevention and control is essential to ensure that patients who undergo any surgical procedure within the operation theatre receive safe and effective care.

A study revealed that the operation theatre should provide a place in which surgical procedure can be undertaken with maximal safety to the patient. Safe working practices must be followed for all patients regardless of known or suspected infection. The principle upon which this practice is based is that of 'Standard and Universal Precautions'. Blood and body fluids of all patients must be considered potentially hazardous for blood borne viruses. Standard precautions assess the activity to be completed and not the individual who is to receive the care. All the patients have the right to be treated with dignity and respect, and the use of standard precautions eliminates the risk of random inappropriate practice, and permits staff to deliver high standards of care to all patients. There are guidelines that are recommended for operating department staff, when invasive procedures are carried out thereby protecting both patients and staff. Every procedure carried out in the operating department should be assessed in terms of blood/body fluid loss and precautions taken accordingly. This study is conducted to assess the gaps between recommended OT infection control guidelines and the practices carried; and providing an intervention to address these gaps.

LITERATURE REVIEW

Operation theatre acquired infections poses a threatening hazard to patients and medical staff which is caused by antibiotic resistant bacteria. Hospital- associated infections are the major cause of patient morbidity and mortality. Invasive procedures, high antibiotic usage and transmission of bacteria between patients, due to improper infection Control measures may explain why OT is one of the "hot zones" of hospital for the emergence and spread of microbial infection. To prevent and control these infections there are some guidelines issues by NABH containing standard and universal precautions to be followed by the staff during treatment. (http://hsccltd.in/other_report/Guideline%20for%20OT%20works_11Aug15.pdf)

Zoning of OT:

The zoning of OT is done on the basis of varying degree of cleanliness, in which the bacteriological count diminishes from outer to inner zone of OT and microbiological count is maintained by differential positive pressure ventilation gradient & temperature from outer inner zone of OT. The flow of patients, staff and materials in OT should be considered during all stages of zoning.
The following four zones of OT are:

1. ZONE1- PROTECTIVE ZONE
   Changing room,
   Store and record room,
   Room for administrative staff,
   Trolley bay

2. ZONE2- CLEAN ZONE
   Clean corridor,

Pre-operative area and Post-operative area,
Sterile store,
Anesthesia room,
Nurse Station,
Scrub station
TSSU

3. ZONE3- STERILE ZONE
   Operation room

4. ZONE4- DIRTY ZONE
   Dirt utility area, Dirty corridor

(http://hsccltd.in/other_report/Guideline%20for%20OT%20works_11Aug15.pdf)

INFECTION PREVENTION AND CONTROL IN OT COMPLEX:

❖ **Standard precautions:**

1. Hand hygiene
2. Personal protective equipment
3. Environment cleaning
4. Prevention of needle stick/sharp injuries
5. Waste management
6. Engineering Controls
   (https://www.slideshare.net/mobile/MoustaphaRamadan81/infection-control-in-operation-room)

A. Hand Washing and Antisepsis:

Hand transmission is one of the most common methods for spreading infection in healthcare setting. Proper hand hygiene is one of the most effective methods for preventing the transfer of microbes between staff and patients. Increasing hand washing compliance by 1.5-2 folds would result in 25-30% decrease in the incidence of HCAI.

Hand hygiene must be practiced-

- After handling any blood, body fluid, secretions, excretions and contaminated items
- Between contact with different patients
- Immediately after removing gloves
- When hands are visibly dirty

Surgical Hand Scrub:

Surgical hand scrub with medicated soap or with alcohol based formulations; either method is suitable for the prevention of SSI.

Protocol for surgical scrub with a medicated soap –

- Scrub each side of each finger, between the fingers, and the back and front of the hand.
- Then scrub the arms, keeping the hand higher than the arm at all times, this will avoid recontamination of the hands by water from the elbows and prevents bacteria-laden soap and water from contaminating the hands.
- Repeat the process on the other hand and arm, keeping hands above elbows at all times.
- Rinse hands and arms by passing the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water.
- Proceed to the operating room holding hands above elbows.
- At all times during the scrub procedure, care should be taken not to splash water onto surgical attire.
- Once in the operating room , hands and arms should be dried using a sterile towel
- Surgical hand scrub of 3-5 minutes is recommended as per the guidelines.

Protocol for surgical scrub with an alcohol-based preparation –

•. Use sufficient product to keep hands and forearms wet with the handrub throughout the procedure.

• After application of the alcohol-based product, allow hands and forearms to dry thoroughly before donning sterile gloves.

• Proceed to the operating room suite holding hands above elbows.
(http://hsccltd.in/other_report/Guideline%20for%20OT%20works_11Aug15.pdf)

Fig 2: showing steps for hand rubbing

For effective hand washing training and compliance for hand-hygiene needs to be monitored

regularly. Availability of hand rubs, soaps, hand towels and water should be ensured. Foot operated or sensored and wall mounted dispensing stations are required. Hand hygiene training programme needs to be done regularly for each category of staff whether doctor, nursing staff or housekeeping staff.

Fig 3: showing five moments of hand-hygiene

B. Personal Protective Equipment:

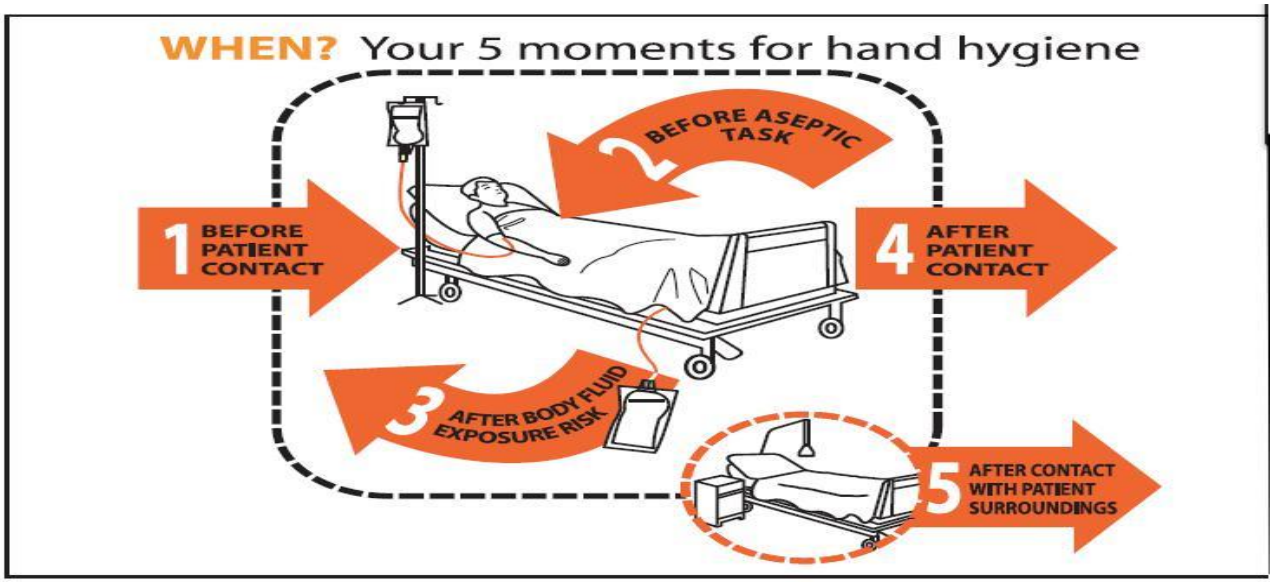
Use of PPE provides a physical barrier between microorganisms and the wearer. It is used by the health care workers who provide direct care to patients and who work in situations where they may have contact with blood, body fluids, excretions or secretions. PPE only reduces the risk of acquiring an infection but does not completely eliminate the risk.

Personal protective equipment (PPE) includes:

- gloves;
- protective eye wear/face shield;
- mask;
- apron;
- gown;
- hair cover
- shoe covers

The following principles guide the use of PPE:

- PPE should be chosen according to the risk of exposure.
- Avoid any contact between contaminated (used) PPE and surfaces, or people outside patient care area.
- Used PPE should be discarded in appropriate bags as per the BMW policy.
- Gloves should be changed between contacts with different patients.



C. "Prevention of needle stick/sharps injuries:"

- Take care to prevent injuries when using needles, scalpels and other sharp instrument or equipment.
- Never recap or bend needles.
- Sharps must be appropriately disinfected and destroyed as per the hospital BMW guidelines.
  (http://ansellhealthcare.com/pdf/edPro/RN_CEU_InfectionControl_Final.pdf)

D. Environment cleaning and decontamination:

The Hospital environment has a crucial part in the development of infection. The "physical design of a hospital operation theatre is an essential component of an infection control strategy, incorporating infection control measures to minimize the risk of infection transmission. The design should support concept of zoning and ventilation standards" in OT.

- The clean and dirty corridor should not be adjacent.
- The traffic flow of clean and dirty items facilitated separately.
- Construction of isolation rooms within the OT.
- Daily and weekly cleaning schedule
- Cleaning of all theatre furniture and equipment should take place at the end of each list. OT table should be thoroughly disinfected & cleaned and should be raised to their full height so bases can be easily & thoroughly cleaned.
- Pre- planned annual cleaning and maintenance (PPM) of OT includes deep cleaning of walls, ceilings etc., painting of walls, changing of ventilation filters, general maintenance and inspection of fixtures, fittings and lights.
- Operating rooms require efficient Heating, Ventilating and Air conditioning (HVAC) system to secure the highly demanding indoor environmental conditions for patients and medical staff.

Air Ventilation

Ventilation systems in OT are designed to minimize microbial contamination. The air conditioning filters should be maintained and cleaned periodically.

High-risk areas such as operating rooms, critical care units and transplant units require special ventilation systems. Filtration systems (air handling units) designed to provide clean air should have high efficiency particulate air (HEPA) filters in high-risk areas. Unidirectional laminar airflow systems should be available in high risk areas. Ultra clean air is valuable in some types of cardiac surgery/neurosurgery/implant surgery theatres and transplant units.

For the operating room, the critical parameters for air quality include:

- Frequent maintenance/validation of efficacy of filters (in accordance with manufacturer's requirements).
- Pressure gradient across the filter bed and in the operation theatre.
- Minimum of 15-20 air changes per hour.
- Air filters through HEPA filters with filtration level up to 0.3 microns and 99.97% efficiency.
- Temperature should be maintained between 18°C and 20°C and humidity between 40% and 60% to inhibit bacterial multiplication.
- Positive pressure gradient maintained by AHU so as to ensure flow of air from sterile to clean and protective zone.
- Recommended floor surface is epoxy resin flooring. Epoxy flooring has been found to be seamless, scratch proof, hard enough for wheeled trolleys, stain free and antistatic.
- Laminar flow which is a low turbulence downward displacement air flow towards the operation zone through stainless steel perforated grills has been planned.

Special air handling for airborne precautions

Negative air pressure vented to the air is recommended for contaminated areas and in isolation rooms of patients with infections spread by the airborne route. An air-handling system providing 6-12 air changes per hour with the air being discharged outside through a filtration mechanism is recommended. Systems must be checked by engineering services to ensure they are in fact offering negative pressure rooms. (http://ansellhealthcare.com/pdf/edPro/RN_CEU_InfectionControl_Final.pdf)

Microbiological Surveillance

Environmental monitoring of surfaces and equipments should be done by microbiological testing. It helps in detecting changing trends of types and counts of microbial flora in indoor air of OT. Biological contaminants occur in the air as aerosols and may include bacteria, fungi, viruses and pollens. (http://medind.nic.in/gaa/t12/i2/gaat12i2p95.pdf)

THEATRE TRAFFIC

Limiting the numbers and movement of staff through the operating theatre environment minimizes the transfer of bacteria, reduces noise pollution and causes fewer disturbances to the

surgical team. To maximize the ventilation, all doors should remain closed when not in use this helps to maintain the air pressure, temperature and humidity of that theatre.

E. Waste management

Hospital waste is a potential reservoir of pathogenic micro-organisms and requires appropriate, safe and reliable handling. The main risk associated with infection is sharps contaminated with blood. There should be a BMW management team responsible for the organization and management of waste collection, handling, storage and disposal. Waste management practices must meet national and local requirements.

Steps in the management of hospital waste include:

- Generation,
- Segregation/separation,
- Collection,
- Transportation,
- Storage,
- Treatment,
- Final disposal.

(http://ansellhealthcare.com/pdf/edPro/RN_CEU_InfectionControl_Final.pdf

❖ CDC recommendation for surgical site infection

<u>Surgical site infection prevention-</u>

✓ Preparation of the patient

1. Whenever possible, identify and treat all infections remote to the surgical site before elective operation and postpone elective surgeries on patients with remote site infections until the infection has resolved.

2. Keep preoperative hospital stays as short as possible.

3. Do not remove hair preoperatively unless the hair at or around the incision site will interfere with the operation. If, needed it has to be removed before the operation with electric clippers

5. Adequately control blood glucose levels in all diabetic patients.

6. Encourage patients to shower or bathe at least the night before the operative day.

7. Use an appropriate antiseptic agent for skin preparation.

8. Apply preoperative antiseptic skin preparation in concentric circles moving towards the periphery. The prepared area should be large enough to extend the incision or create new incisions or drain sites, if necessary.

✓ Antimicrobial prophylaxis

Antibiotic prophylaxis should be given within 60 minutes before the incision and the antibiotics should be stopped within 24 hours after surgery.

✓ Surgical attire and drapes

1. Wear a surgical mask that fully covers the mouth and nose when entering the operating room.

2. Wear a cap to fully cover the hair on the head when entering the operating room.

3. Wear sterile gloves if a scrubbed surgical team member. Put on gloves after donning a sterile gown.

5. Change scrub suits that are visibly soiled, contaminated, and/or penetrated by blood or other potentially infectious materials.
(https://asahq.org/~/media/sites/asahq/files/public/resources/asa%20committees/recommendations-for-infection-control-for-the-practice-of-anesthesiology.pdf)

❖ UNIVERSAL PRECAUTIONS

Spill management of blood and body fluids-

- Where possible, isolate spill area.
- Protective equipment like Gloves and plastic apron must be worn.
- The area should be wiped thoroughly using disposable paper towels.
- The area should be cleaned using neutral detergent and warm water.
- Recommended concentration of presept 1 tab in 2.5 liters should be used to decontaminate the surface.
- Used gloves, apron/ towels should be disposed in yellow plastic bag as per the hospital BMW policy.
- Wash hands after the procedure.
(https://www.slideshare.net/mobile/MoustaphaRamadan81/infection-control-in-operation-room)

RESEARCH METHODOLOGY:

AIM:

To do the gap analysis study of current practices with the desired OT infection control standards of MSSH, Saket.

OBJECTIVE OF THE STUDY:

- To measure the present practices
- To compare it against standards

- To identify the potential gaps by analyzing the current practices with the desired hospital OT infection control guidelines

METHODS:

The tool used for the assessment is checklist which recorded response in the form of 'Yes' or 'No' format. The checklist includes Standard Precautions, Universal precautions and CDC recommendations. Observations were carried out during working hours, randomly 3-4 staff were selected and observed. At the end of the surgical procedure housekeeping procedure were observed. To avoid study bias healthcare personnel were not informed that they were being monitored. Adhere to the Hospital Infection Control Guidelines in OT were assessed through the evaluation of quantitative data obtained from checklist. The greater the number of 'Yes', higher the compliance with (adherence to) OT infection control Guidelines. Although 100% adherence to the OT hospital infection control guidelines would be idealistic that would not be possible in real.

i. **Research Design:** The research design adopted for study will be Descriptive study design.
ii. **Setting:** Setting of study will be in MSSH, Saket
iii. **Duration of study:** The project timeline consists of 1 month period.
iv. **Data Collection Tool:** Primary Data: Checklist
Secondary Data: Publications, Journals, Guidelines, Literatures, Previous Records

DATA ANALYSIS& INTERPRETATION:

Table1: Represents the infection control practices carried inside the OTs of MSSH, Saket

S. No.	Questions	Renal OT (Minor)	Oncology, Cardiac and Plastic Surgery OT	Neurology, Urology and General surgery OT	MAMBS OT	RESULTS
1.	Is proper zoning protocol followed?	Y	Y	Y	Y	100% adherence to the protocol of having proper zoning protocol being followed in all OT.
2.	Is yellow line displayed?	Y	Y	Y	Y	100% adherence to the protocol of displaying yellow line.
3.	Personnel entering an operation theatre are in surgical attire.	Y	Y	Y	Y	100% adherence to the practice of wearing surgical attire before entering into operation theatre
4.	Surgical attire is taken, surgical mask covering the mouth, nose and beard, surgical cap covering the hairs before entering the operating room.	Y	Y	Y	Y	100% adherence to the practice of wearing surgical attire (surgical mask, surgical cap) before entering into operation room.
5.	OT complex having unidirectional flow movement.	N	N	N	N	The practice of having unidirectional movement is not upto the mark in any of the OTs.
6.	Double door airlock at the entry and exit of the OT complex.	Y	Y	Y	Y	100% adherence to the protocol of having double door airlock at the entry and exit of the OT.
7.	Antiseptic detergent available					100% adherence to the protocol of

	at all sinks including change room and toilets.	Y	Y	Y	Y	having antiseptic detergent available at all sinks including change room and toilets.
8.	Appropriate alcoholic hand rub available at the entrance of the theatre and in all patient care areas (anesthetic and recovery room).	Y	Y	Y	Y	100% adherence to the protocol of having appropriate alcoholic hand rub available at the entrance of the theatre and in all patient care areas
9.	Paper towel available at all sinks.	Y	Y	Y	Y	100% adherence to the practice of having Paper towel available at all sinks.
10	Poster demonstrating a good hand washing technique available at all sinks.	Y	Y	N	N	50% adherence to the protocol of displaying Poster demonstrating a good hand washing technique available at all sinks
11	Is green line displayed.	Y	Y	Y	Y	100% adherence to the protocol of displaying green line.
12	Clean area linked to OT through door.	Y	Y	Y	Y	100% adherence to the protocol of linking clean area to OT.
13	Pre and post OP rooms located in such, that there will not be any criss-cross of pre and post OP patients.	N	N	N	N	This standard is not followed in any of the OTs. There is no separation of Pre-Post OP rooms.
14	No toilets inside the clean area of OT complex.	Y	Y	Y	N	3out of 4 OTs i.e. 75% of adherence to this protocol. Only one OT is not following this standard
15						100% adherence to

	Pre operative skin antiseptics properly stored and handled to prevent contamination.	Y	Y	Y	Y	the protocol of properly storing & handling pre-operative skin antiseptics.
16	Cleaning and disinfection of theatre environment and equipment including blood spillage done regularly as per infection control guidelines.	Y	Y	Y	Y	100% adherence to the protocol for cleaning & disin - fection of theatre environment as per infection control guidelines.
17	Pre-planned annual cleaning and maintenance of walls, ceilings etc., painting of walls, changing of ventilation filters.	Y	Y	Y	Y	100% adherence to the protocol of pre-planned annual cleaning & maintenance of walls
18	Cleaning of all theatre furniture and equipment take place at the end of each list.	Y	Y	Y	Y	100% adherence to the protocol for cleaning all theatre furniture and equipment at the end of each list.
19	Is red line displayed?	Y	Y	Y	Y	100% adherence to the protocol of displaying red line followed in all the OTs.
20	Ventilation system (filter types/frequency of air/ pressure/temperature/humidity) are maintained and checked regularly.	Y	Y	Y	Y	100% adherence to the protocol of maintaining ventilation system regularly.
21	Height of concrete ceiling >4m for effectiveness of laminar flow.	Y	Y	Y	Y	100% adherence to the standard of having height of concrete ceiling >4m
22	AHU capacity more than4500 CFM capacity.	Y	Y	Y	Y	100% adherence to the standard of having AHU of more than 4500VFM capacity,
23						100% adherence to

	Terminal HEPA filters of 0.3 micron installed in OT.	Y	Y	Y	Y	the standard of having terminal HEPA filters of 0.3 micron
24	Air quality at supply of class100 (measuring 0.5microns or large particles).	Y	Y	Y	Y	100% adherence to the standard for maintaining air quality at supply of class100
25	Positive pressure of 2.5 Pascal maintained inside the OT.	Y	Y	Y	Y	100% adherence to the standard for maintaining positive pressure of 2.5 Pascal
26	Temperature at 21 +/- 3 degree Celsius and relative humidity between 40to 60% maintained inside the OT.	Y	Y	Y	Y	100% adherence to the standard for maintaining temperature & pressure.
27	Air velocity as per the international guidelines (90-120 FPM at grillers/diffuser level).	Y	Y	N/A	Y	100% adherence to the standard for maintaining air velocity
28	15-20 air changes per hour.	Y	N/A	N/A	Y	100% adherence to the standard for maintaining air changes.
29	Scrub room in between OT or nearby place of OT.	Y	Y	Y	Y	100% adherence to the protocol of having scrub room in between OT or nearby place of OT
30	Scrub room equipped with plumbing line for supply of water and drain line for outflow of water from scrubber.	Y	Y	Y	Y	100% adherence to the protocol of having scrub room equipped with plumbing line for supply of water and drain line for outflow of water from scrubber.
31	One TSSU room with in the OT complex.	N/A	N	Y	N	2 out of 4 specialized OTs don't have TSSU

						only 1 specialized OT has TSSU.
32	TSSU room well ventilated and equipped with plumbing system and drain line.	N/A	N/A	Y	N/A	100% adherence to this standard is only followed in one specialized OT .
33	OT having auto-sliding door.	Y	Y	Y	Y	100% adherence to this standard of having auto-sliding door.
34	No fire sprinkler inside the operating room.	Y	Y	Y	Y	100% adherence to the standard of having not fire sprinkler inside the operating room.
35	OT wall/metallic panel coated with antibacterial/epoxy painting by 300 microns thickness.	Y	Y	Y	Y	100% adherence to the standard of having OT wall/metallic panel coated with antibacterial/epoxy painting
36	Operating team scrub their hands prior to operation using an antiseptic detergent ensure that hands and nails are visibly clean.	Y	Y	Y	Y	100% adherence to the practice of scrubbing hands by operating team prior to operation using an antiseptic detergent
37	Hand held higher than elbows	Y	Y	Y	Y	100% adherence to the practice of holding hands higher than elbows.
38	Surgical scrub at least 3-5 minutes (up to elbow) using appropriate antiseptic.	Y	Y	Y	Y	100% adherence to the practice of scrubbing hands for at least 3-5 min.
39	Hand antisepsis done again when proceeding from one case to another.	Y	Y	Y	Y	100% adherence to the practice of doing hand antisepsis when proceeding from one case to another
40	Double gloving practiced by staff.	N	N	N	N	This practice is not followed by any of

						the OT staff.
41	Staff wearing FFP2/FFP3 respirator mask in case of airborne transmission	Y	Y	Y	Y	100% adherence to the practice of wearing FFP2/FFP3 respirator mask when required
42	Hands dried using separate towel for each hand before donning a sterile gown and gloves.	Y	Y	Y	Y	100% adherence to the practice of drying hands before donning a sterile gown and gloves.
43	Single use items not reused.	Y	Y	Y	Y	100% adherence to the practice of not reusing single use items.
44	Minimal movement of team and talking practiced inside the OT.	Y	Y	Y	Y	100% adherence to this practice.
45	No touch contamination when attaching needle to syringe.	Y	Y	Y	Y	100% adherence to the practice of no touch contamination when attaching needle to syringe
46	Antibiotic prophylaxis within 60 minutes of knife to skin.	Y	Y	Y	Y	100% adherence to the practice of giving antibiotic prophylaxis within 60 minutes
47	Hair removal where required, performed with electric clipper with a disposable head.	Y	Y	Y	Y	100% adherence to the practice of removing hair with electric clipper when required
48	Is blue line displayed?	Y	Y	Y	Y	100% adherence to the protocol of displaying blue line
49	Dirty instruments and wastes properly handled and transported.	Y	Y	Y	Y	100% adherence to the practice for properly handling and transporting dirty instruments & wastes.
50	OT linked to dirty corridor					This standard is not followed. There is

	through Hatch box.	N	N	N	N	no separate corridor for removal of wastes.
51	Blue cloth tray covers sent to CSSD in plastic bags.	N/A	N/A	N/A	N/A	This is single use item. it has been discarded after use.
52	Soft materials, e.g. BP cuffs thoroughly washed and dried.	Y	Y	Y	Y	100% adherence to this practice
53	Trolley and OT table cleaned with detergent and disinfected after each case.	Y	Y	Y	Y	100% adherence to the practice of disinfecting trolley & OT table after each case.
54	Waste disposal system well maintained in OT.	Y	Y	Y	Y	100% adherence to the practice of disposing waste.
55	Biomedical waste disposed at the point of generation only.	Y	Y	Y	Y	100% adherence to the practice of disposing biomedical waste at the point of generation
56	Hand washing immediately after removing gloves.	Y	Y	Y	Y	100% adherence to the practice of washing hands after removing gloves.
57	Waste bags should be three quarter filled only, sealed, dated and labeled with theatre number.	Y	Y	Y	N	75% adherence to this practice.
58	Transportation of biomedical waste in closed container not criss crossing clean corridor.	N	N	N	N	This practice is not upto the mark in any of the OTs as waste is transported in such a manner that it criss- cross the patient care area.
59	Are occupational infections reported?	Y	Y	Y	Y	100% adherence to the protocol of reporting occupational infection
60	Do employees know how to	Y	Y	Y	Y	100% adherence to

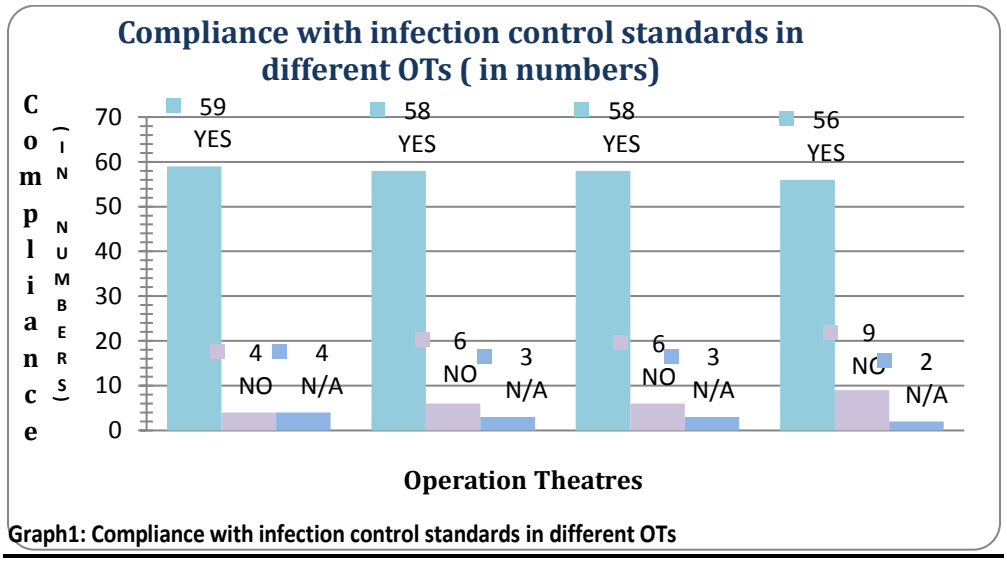
	report occupational infection?					this practice.
61	Does hospital investigate occupation related infection?	Y	Y	Y	Y	100% adherence to the practice of investigating occupational infection
62	Does training related to infection prevention and control during the perioperative period given to theater staff?	Y	Y	Y	Y	100% adherence to the practice of giving training to OT staff.
63	Does staff know how to access infection control policies?	Y	Y	Y	Y	100% adherence by the staff to the practice of accessing infection control policies.
64	Does staff adhere to the infection control policies?	Y	Y	Y	Y	100% adherence by staff
65	Cultural Surveillance	Y	Y	Y	Y	100% adherence. It has done every month at the end of each week
66	Fumigation	Y	N/A	N/A	N/A	1 out of 4 OT is fumigated rest all the OTs are disinfected with Bacillocidrant spray

Table 2: Represents checklist response in terms of total no. of YES, NO& N/A and shows adherence to the OT infection control guidelines (in numbers) for all the OTs.

Questions Response	**Renal OT (Minor)**	**Oncology, Cardiac and**	**Neurology, Urology and**	**MAMBS OT**

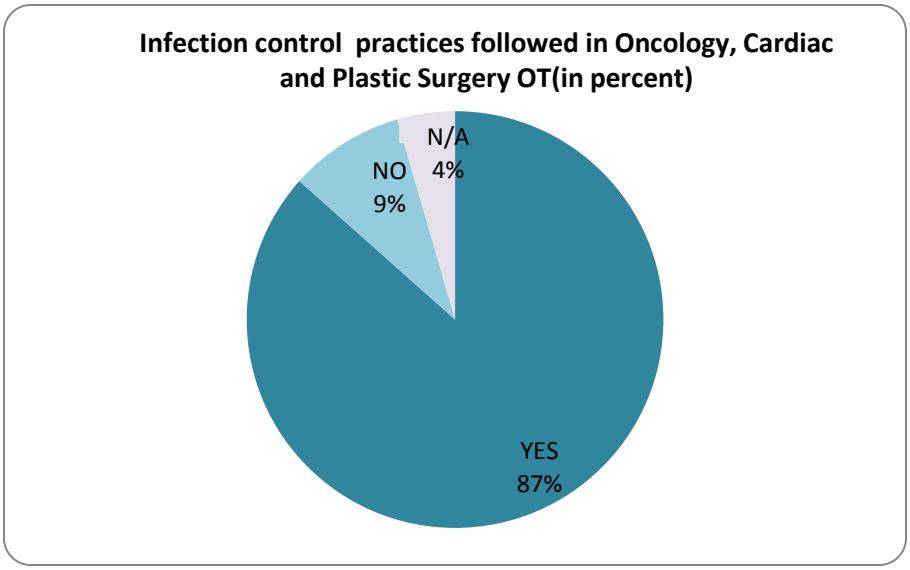
		Plastic Surgery OT	General surgery OT	
No. of Yes	59	58	58	56
No. of No	4	6	6	9
No. of N/A	4	3	3	2

INTERFERENCE: Using data from table 2 a graph has been which shows that all the OTs have compliance of more than 80%, but, among them Renal OT(Minor) has the highest and the MAMBS OT has the lowest compliance.



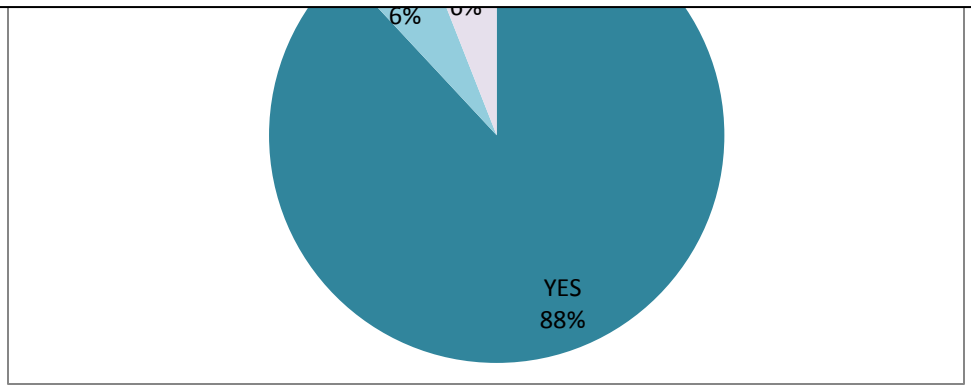
Graph1: Compliance with infection control standards in different OTs

INTERFERENCE: It has been interpreted that 88% (59/67) compliance with hospital infection control guidelines, 6 %(4/67) of the practices are not followed upto the mark as per the standard of hospital infection control policies, rest 6 %(4/67) is not applicable to Minor OT (Renal OT).

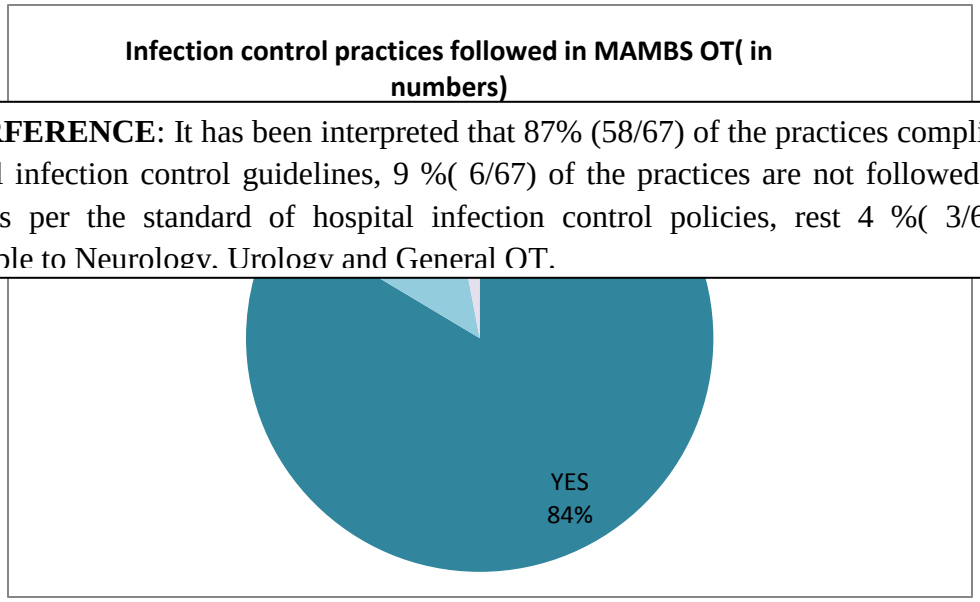


Graph2: % of infection practices Represents current control followed in Renal OT

INTERFERENCE: It has been interpreted that 87% (58/67) of the practices compliance with hospital infection control guidelines, 9 %(6/67) of the practices are not followed up to the mark as per the standard of hospital infection control policies, rest 4 %(3/67) is not applicable to Oncology, Cardiac and Plastic Surgery OT.

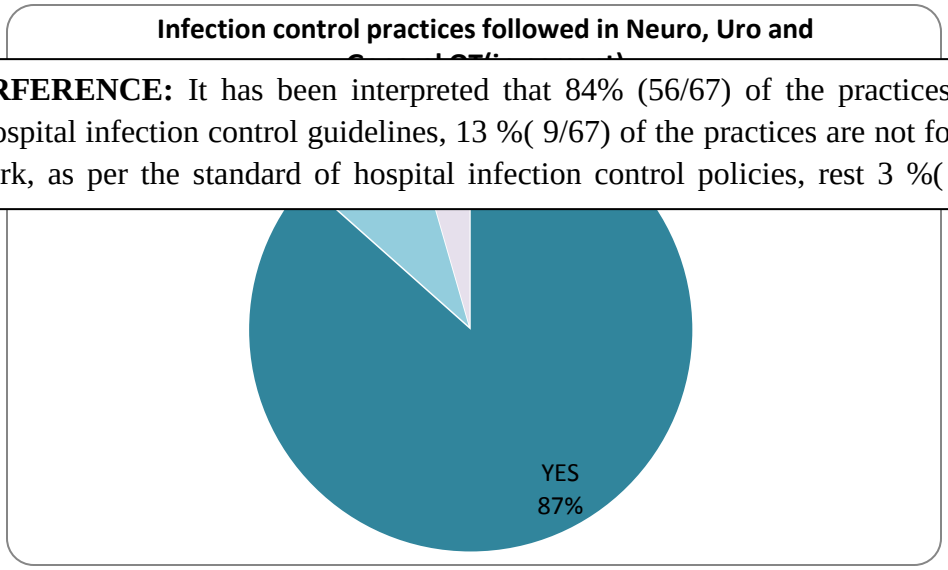


Graph3: Represents % of current infection control practices followed in Oncology, Cardiac and Plastic Surgery OT



INTERFERENCE: It has been interpreted that 87% (58/67) of the practices compliance with hospital infection control guidelines, 9 %(6/67) of the practices are not followed up to the mark as per the standard of hospital infection control policies, rest 4 %(3/67) is not applicable to Neurology, Urology and General OT.

Graph4: Represents % of current infection control practices followed in Neurology, Urology and General Surgery OT



INTERFERENCE: It has been interpreted that 84% (56/67) of the practices compliance with hospital infection control guidelines, 13 %(9/67) of the practices are not followed up to the mark, as per the standard of hospital infection control policies, rest 3 %(2/67) is not

Graph5: Represents % of current infection control practices followed in MAMBS OT

OBSERVATION:

Few gaps were found between desired and existing standards in operation theatre which are enlisted below.

- Pre and post- operative area are not located separately.
- Except for Neurology, Urology and General surgery OTs rest OTs don't have TSSU.
- It has been observed that in one of the Oncology operating room, nurse was not wearing surgical gloves while opening the sterile equipment
- Biomedical waste is not handled properly. The surgical mask and caps in changing room of west block OT are not discarded according to BMW handling policy of hospital. They were discarding in black bins due to small size of red bin, available in changing room of Neurology, Urology and General Surgery OT.
- Presence of washroom inside the clean zone of MAMBS OT.
- Dirt utility area is inside the clean zone- It is in front of the pre and post- operative area of MAMBS OT.
- The trolley containing soiled linen bag is overfilled.
- Soiled (dirty) linen bags carried openly from front of pre- post operative area (clean zone) of OT.
- The staff is moving outside the OT complex wearing scrub suit and scrub shoes.

RECOMMENDATIONS:

In view of vital gaps there is an essential requirement to take remedial steps for streamlining the processes as under-

- TSSU inside the theatre gives an add on advantage. Sterile drapes, gloves, gown and other ready to use item are stored in TSSU.

- While handling the sterile equipments aseptic conditions need to be maintained (wearing of gloves by OT staff).

- The waste generated has to be discarded according to hospital biomedical waste handling policy at the point of generation only. Large red color bins has to be provided in spite of small so as to avoid discarding surgical caps and masks into black bins.

- On interviewing staff it has been seen that reason for constructing it inside is, there is a need for patients, who are under observation for a day or night before or after the surgery in pre or post operative area. If there is such need then it has to be constructed in the protective zone. Because construction of it inside the clean zone makes the environment favorable for the colonization of bacteria by increasing humidity and hence increase in the infection rate.

- To decrease the incidence of infection in OT, dirt utility has to be located outside the clean zone of OT, away from the patient care area.

- To avoid the overfilling of bins and trolley (soiled linen), waste has to be removed from OT at frequent intervals.

- The trolley containing waste should be removed from separate corridor and too with covered lids, so that it does not have access to patient care area; otherwise this will lead to increase in the bacteriological count in clean zone.

- While moving out of the OT, it has to be mandatory to change the attire (scrub suit and scrub shoes); else this will carry the dirt and leads to increase the bacteriological count of clean and sterile zone environment of OT.

CONCLUSION:

Despite the proven efficacy of 80 percent of infection control practices for preventing and controlling HCAI inside OT compliance with the hospital standards. There were some vital gaps identified through study that needs to be filled, so as to maintain the low incidence rate of infection inside the OT complex. The gaps have been seen in compliance with standard precautions like double gloving practiced by staff, use of surgical attire (surgical gloves by

nursing staff), management of biomedical waste etc. The relevant hospital authority should pay attention towards compliance with standard precautions.

ANNEXURE

CHECKLIST

Operation Room: _____

S.No.		YES	NO	COMMENTS
	PROTECTIVE ZONE			
1	Is proper zoning protocol followed?			
2	Is yellow line displayed?			
3	Personnel entering an operation theatre are in surgical attire.			
4	Surgical attire is taken, surgical mask covering the mouth, nose and beard, surgical cap covering the hairs before entering the operating room.			
5	OT complex having unidirectional flow movement.			
6	Double door airlock at the entry and exit of the OT complex.			
7	Antiseptic detergent available at all sinks including change room and toilets.			
8	Appropriate alcoholic hand rub available at the entrance of the theatre and in all patient care areas (anesthetic and recovery room).			
9	Paper towel available at all sinks.			
10	Poster demonstrating a good hand washing technique available at all sinks.			
	CLEAN ZONE			
11	Is green line displayed.			
12	Clean area linked to OT through door.			
13	Pre and post OP rooms located in such, that there will not be any criss-cross of pre and post OP patients.			
14	No toilets inside the clean area of OT complex.			
15	Pre operative skin antiseptics properly stored and handled to prevent contamination.			
16	Cleaning and disinfection of theatre environment and equipment including blood spillage done regularly as per infection control guidelines.			
17	Pre-planned annual cleaning and maintenance of walls, ceilings etc., painting of walls, changing of ventilation filters.			
18	Cleaning of all theatre furniture and equipment take place at the end of each list.			
	STERILE ZONE			

20	Is red line displayed?			
21	Ventilation system (filter types/frequency of air/ pressure/temperature/humidity) are maintained and checked regularly.			
22	Height of concrete ceiling >4m for effectiveness of laminar flow.			
23	AHU capacity more than4500 CFM capacity.			
24	Terminal HEPA filters of 0.3 micron installed in OT.			
25	Air quality at supply of class100 (measuring 0.5microns or large particles).			
26	Positive pressure of 2.5 Pascal maintained inside the OT.			
27	Temperature at 21 +/- 3 degree Celsius and relative humidity between 40to 60% maintained inside the OT.			
28	Air velocity as per the international guidelines (90-120 FPM at grillers/diffuser level).			
29	15-20 air changes per hour.			
30	Scrub room in between OT or nearby place of OT.			
31	Scrub room equipped with plumbing line for supply of water and drain line for outflow of water from scrubber.			
32	One TSSU room with in the OT complex.			
33	TSSU room well ventilated and equipped with plumbing system and drain line.			
34	OT having auto-sliding door.			
35	No fire sprinkler inside the operating room.			
36	OT wall/metallic panel coated with antibacterial/epoxy painting by 300 microns thickness.			
37	Operating team scrub their hands prior to operation using an antiseptic detergent ensure that hands and nails are visibly clean.			
38	Hand held higher than elbows			
39	Surgical scrub at least 3-5 minutes (up to elbow) using appropriate antiseptic.			
40	Hand antisepsis done again when proceeding from one case to another.			
41	Double gloving practiced by staff			
42	Staff wearing FFP2/FFP3 respirator mask in case of airborne transmission			
43	Hands dried using separate towel for each hand before donning a sterile gown and gloves.			
44	Single use items not reused.			
45	Minimal movement of team and talking practiced inside the OT.			
46	No touch contamination when attaching needle to syringe.			
47	Antibiotic prophylaxis within 60 minutes of knife to skin.			

48	Hair removal where required, performed with electric clipper with a disposable head.			
	DIRTY ZONE			
49	Is blue line displayed?			
50	Dirty instruments and wastes properly handled and transported.			
51	OT linked to dirty corridor through Hatch box.			
52	Blue cloth tray covers sent to CSSD in plastic bags.			
53	Soft materials, e.g. BP cuffs thoroughly washed and dried.			
54	Trolley and OT table cleaned with detergent and disinfected after each case.			
55	Waste disposal system well maintained in OT.			
56	Biomedical waste disposed at the point of generation only.			
57	Hand washing immediately after removing gloves.			
58	Waste bags should be three quarter filled only, sealed, dated and labeled with theatre number.			
59	Transportation of biomedical waste in closed container not criss crossing clean corridor.			
60	Are occupational infections reported?			
61	Do employees know how to report occupational infection?			
62	Does hospital investigate occupation related infection?			
63	Does training related to infection prevention and control during the perioperative period given to theater staff?			
64	Does staff know how to access infection control policies?			
65	Does staff adhere to the infection control policies?			
66	Cultural Surveillance			
67	Fumigation			

Hospital Infection Control Manual - https://sites.google.com/a/hopehospitals.in/for-dot-in/hospital-infection-control

Revised Guidelines for Air Conditioning in Operation Theatres - http://nabh.co/images/pdf/RevisedGuidelines_AirConditioning_OT.docx

ABBREVIATION

HCAI	Healthcare- Associated infection
OT	Operation Theatre
SSI	Surgical Site Infection
AHU	Air Handling Unit
ACH	Air Changes per Hour
HEPA	High Efficiency Particulate Air
HVAC	Heat, Ventilation, Air Conditioning
PPE	Personal Protective Equipment
CDC	Centre for Disease Prevention and Control
MAMBS	Minimal Access Metabolic and Bariatric Surgery

TSSU	Theatre Sterile Supple Unit
FPM	Feet per minute
VFD	Variable frequency devices
RH	Relative Humidity
BMW	Bio Medical Wastes

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