



# SINHGAD TECHNICAL EDUCATION SOCIETY'S SMT.KASHIBAI NAVALE MEDICAL COLLEGE & GEN.HOSPITAL



## OPERATION THEATRE MANUAL



# OPERATION THEATRE MANUAL

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# CHAPTER 1: OPERATING THEATRE DESIGN AND ADMINISTRATION

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This section will briefly deal with the design, layout, work flow and administrative responsibilities of the Operating Theatre (OT) Manager. The OT team works closely together with the surgeons, nurses and OT technicians. Therefore the work and relaxation areas for staff are well demarcated yet accessible from the outside if required.

There is a separate clean area for the entry of surgical instruments and other equipment, and there is a demarcated area for used or soiled surgical instruments to be rinsed before sending to the Central Sterile Services Department (CSSD). The layout accommodates the arrival of patients and the recovery area post operatively.

## 1.1 Layout and Design

Theatre managers, infection control team, surgeons and anaesthesiologists are involved in the planning of the theatre design/layout. The operating theatre suite is a purposely built independent complex located away from the main flow of traffic but it is in an area easily accessible to the critical care, surgical and maternity wards and the supporting service departments, e.g. CSSD, laboratory and X-ray departments.

The operating theatre should have an independent air handling unit with controlled ventilation such that the lay-up room and the OT table is under positive pressure and has the most Air Changes per Hour (ACH) i.e. 20-24.

The traffic within the operating suite is controlled. It only allows access to staff, patients and equipment from different entrances and exits. There is no thoroughfare through the OT.

### 1.1.1 Walls and Ceilings

All surface materials are hard, nonporous, fire resistant, waterproof, stain proof, seamless and easy to clean. In addition the corners of the walls and the floor are coved (round) and smooth for easy cleaning. Washable paint for the walls is present in OT complex 2 and metallic sheet coated walls are present in OT complex 1 both of them withstand a daily washing programme. Tiles are not used in walls.

The walls and ceiling are used to mount essential devices and equipment to reduce crowding of the floor area. Thus these walls are solid and robust enough to carry the weight of equipment. The ceiling has pendulum devices for outlets for oxygen and other medical gases and vacuum.

There is no scavenging system in OT. There are multiple electric outlets on the walls and on pendulum for purpose of electronic devices in OT.

### **1.1.2 Floors**

Floors are smooth, without cracks and breaks, made of materials that reduce static and does not endanger the safety of personnel. The surface of the floor provides a path of moderate electrical conductivity between all persons and equipment making contact with the floor to prevent the accumulation of dangerous electrostatic charges. The floor coverings are as per the recommendations and are easy to clean. The floor covering is curved up the wall to 2.5 cm, thus ensuring that edges are coved and easier to clean than right angled floors.

The floor surface is suitably hard, nonporous and appropriate for frequent cleaning and there are no cracks. The floors have a nonslip surface, to prevent staff from slipping and injuring themselves. When floors are being cleaned, a warning sign “wet floor” are put up to warn the personnel.

### **1.1.3 Doors**

Sliding doors are used in OT complex 2 and swing doors (self-closing) are used in the OT Complex 1. This is essential during an operation because the microbial count in the air rises every time doors swing open from either direction. There is a clear glass viewing window in the door to prevent frequent opening and closing of the door.

Entrances of the OT doors have air curtains to balance the airflows at various places.

### **1.1.4 Lighting**

Most OT lights are white fluorescent as they cast minimal shadow. Lighting is evenly distributed throughout the room. The anaesthesiologist also has sufficient light.

The overhead operating light:

- a) Is near daylight in colour and free of shadow
- b) Gives contrast to the depth and relationship of all anatomic structures. The light is equipped with an intensity control mechanism. The surgeon may ask for more light when needed therefore a reserve light is available (e.g. a mobile operation light).
- c) Is freely adjustable to any position or angle. Overhead operating lights are ceiling mounted on mobile fixtures. It can be positioned so that light is directed into a single incision or two concurrent operative sites.
- d) Is spark-proof where anaesthetic gases are used.
- e) Produces minimum heat to prevent injury to exposed tissues, to ensure the comfort of the sterile team, and to minimize airborne micro-organisms.
- f) Can be easily cleaned. Tracks recessed within the ceiling virtually eliminate dust accumulation.

Operation theatre has a generator back up in case of power failure. In case one of the bulbs is not working, it is replaced as soon as possible, to provide sufficient lighting at all times during an operation.

### **1.1.5 Ventilation**

The ventilating system in the OT is mechanical ventilation, supplied from an independent air handling unit (AHU) which ensures a controlled, filtered, clean air supply. Air changes and circulation provide fresh air and prevent accumulation of anaesthetic gases in the room.

#### **1.1.5.1 *Types of Operating Theatres***

We have a central air conditioning in all the theatres.

Ventilation in all OTs is the ultra-clean or laminar flow OT. Here, 80% of extremely clean air is re-circulated via a canopy above the operating area, and this unidirectional airflow can be up to 300 m/s (meters per second) forming a curtain of air.

Wall mounted or floor standing air conditioners are not used for providing clean air in a sterile environment as they only cool the air and are strongly discouraged. The filters clog up easily with dust which comes in directly from the outside and need frequent changing. They do not remove stale air from the OT which increases the risk of infection.

### **1.1.6 Air Flows**

In the OT there is always a positive pressure which enters the OT suite in the preparation or layup room, to ensure safety of the surgical instruments when the trolleys are being laid up for surgical procedures. The Layup and OTs have the highest positive air pressure which flows outwards to the scrub areas, and sub-sterile rooms. Positive pressure forces air out of the room.

Air-conditioning units may be a source of micro-organisms that pass through the filters. These are changed at regular intervals to prevent this and the ducts must be cleaned regularly according to the manufacturer's recommendations.

### **1.1.7 Temperature and Humidity**

The temperature is maintained at 21 +/- 3 degrees Celsius inside the OT all the time with corresponding relative humidity between 50 to 60%. Appropriate devices to monitor and display these conditions inside the OT are installed.

Moisture provides a relatively conductive medium, allowing static to leak to earth as fast as it is generated. Sparks form more readily with low humidity and fires are a potential hazard.

### **1.1.8 Gas Scavenging System for Anaesthetic Explosive Gases**

There is no gas scavenging system in OT.

## 1.2 Administration in the Operating Theatre

### 1.2.1 The Operating List

The nurse in charge of the OT has the sole responsibility of managing all the activities of the OT. The activities include among others the theatre lists and communication with the surgeons in case of changes in the operation list.

The nurse in charge of the OT has given all the necessary support to correctly execute his/her responsibilities regarding theatre activities.

There is a written operation list for all elective cases. This helps the OT staff to adequately prepare for the surgical procedures.

#### **The following is followed:**

- The operation list is sent by 3 pm on the day before the operation.
- The operation list is handed in physically and **NOT** telephonically.
- The name and designation of the Doctor who compiled the theatre list is be clearly indicated.
- The surgeon discusses the operation list in co-operation with the OT nurse-in-charge and OT in charge (HOD/professor anaesthesia).
- The operation list does not exceed the permitted time allocated to it. Note: this does not refer to the time during an operation of an individual patient)
- The operation list is put on a notice board near the patient's admission/ entrance to the OT.

#### ***1.2.1.1 Facts that are taken into consideration when operations are booked***

- The age of the patient plays an important role, for example an infant or a small child is not placed at the end of a list. The same applies to the elderly person.
- Types of operations – major operations e.g. laparotomy are always booked at the beginning of the operation list.
  - A diagnosed abscess or in case of doubt/uncertainty, the operation is preferably done at the end of the slate.
- Emergency cases such as acute abdomen and caesarean section should always be considered a priority.
- Patients with a state of disease such as Diabetes Mellitus are not starved for long periods as they patient may become comatose.
- Abbreviations are avoided e.g. D&C (dilatation and curettage) as abbreviations may cause confusion to personnel.



### ***1.2.1.2 Particulars that Appear on the Operating List***

- The time, day, and date when the operation will be performed.
- Full names, surname, gender, age as well as the form of address e.g. Mr. Mrs or Miss.
- The name of the ward in which the patient lies, as well as the sex e.g. male or female.
- A clear description of the type of operation to be performed. When an operation is to be performed on an extremity, or inguinal hernia repair, it is clearly indicated which side e.g. left or right, and it is checked with the patient as well. This is important to prevent an operation being performed on the wrong side or the wrong operation.
- The scheduled sequence for the operations appears on the list. If the surgeon decides to do a patient earlier or later on the scheduled list or cancel an operation, the OT nurse is informs the nurse in the particular ward of the change on the operating list immediately.
- The name of the surgeon appears on the operation list.
- It is indicated whether it is major or minor case.

### **1.2.2 The Registers Used in the Operating Theatres**

Different registers are used in the OT, namely:

1. Operation registers
2. Register regarding abortions and pregnancy residues
3. Poison drug register
4. Specimen register for biopsies
5. Death register

#### ***1.2.2.1 Operating Register***

Every operation done in the OT, whether under general or local anaesthesia, is recorded in the operation register.

The operating register is a legal document, so are the operating slips, and both are stored in the section for enquiry as well as for statistical purposes for at least five years.

All the information and particulars of the patient which appear on the operating slip are complete and in detail and are recorded in the operating register:

- The patient's full names and surname
- Registration number and age
- Ward in which the patient is admitted
- Full description of the operation performed
- Initials and surname of anaesthesiologist
- Type of anaesthesia given
- Name of scrub nurse, as well as the amount of specimens sent to the laboratory
- Indicate whether the patient is male or female
- Indicate whether the patient underwent major or minor surgery
- Duration of the operation

It is every nurse's responsibility to record his/her operation slips of the day's operations, for which s/he acted as scrub nurse, in the operating register and to sign next to it.

The scrub nurse who counted the swabs mandatorily signs the register daily before s/he goes off duty.

The monthly statistics are kept up to date

Every new month's operations are started on a new page with the relevant month written on top of the page. These slips are kept in the section and in a special storing or filling area.

If a patient goes into cardiac arrest in the theatre or dies on the operating table, this information is recorded in red in the operation register.

#### ***1.2.2.2. Register regarding Abortions and Pregnancy Residues***

Operations like abortion or the removal of pregnancy residues are separately recorded with the particulars of such an operation.

There is a special register for the purpose of abortions and the removal of pregnancy residues.

The register and other relevant documents are kept for at least five years. The register has the following information:

- Name and surname of patient
- Registration number
- Age/ marital status/ nationality
- Name and surname of the doctor who referred the patient
- Name of the assistant surgeon if applicable
- Description of the operation being performed
- Name and surname of the anaesthesiologist
- Type of anaesthesia used

Monthly statistics are kept up to date. The special form for the notification of the operation pertaining to an abortion and the removal of pregnancy residues is completed in duplicate. The original forms on a monthly basis are sent to the medical superintendent's office for cognizance. The duplicate remains in the theatre and are filed.

### ***1.2.2.3 Poison drug Register***

A variety of medicines are used in the theatre, especially for the administering of anaesthesia.

We maintain a strict control of all the different medicines, as well as proper recording into registers. Schedule 3 and 4 and Schedule 4 medicines are not stored in the same poison cupboard, but in separate cupboards, which are clearly marked "Poison Schedule 5".

- The poison cupboards are in a proper place and must be wall-mounted
- The poison cupboards have a double lock and the keys are kept by the nurse in charge
- The keys are not be given to any unauthorized person or left in drawers

**The poison drug register is checked once a week by the nurse in-charge /pharmacist of that section. This register is kept for at least five years.**

#### ***1.2.2.4 Specimen Register for biopsies***

For efficient control over specimens, there is a book/ register in which all specimens are recorded, with the same information as on the label. A space is made available for the signature of the person who recorded the specimen into the book/ register, as well as the signature of the person who received the specimen at the laboratory.

- The specimen are clearly marked with the following information on the label:
  - The name and surname of the patient
  - The registration number
  - The ward in which the patient is placed
  - The type of specimen
  - The name of the operation
  - The date and time when the specimen was taken
  - The required laboratory test
  - The name of the surgeon
  
- At the end of the day's operating schedule the nurse checks all specimens with the entries in the book/ register

- A reliable person, for example the porter, then takes the specimens and the book/ register to the laboratory and the person who receives them at the laboratory signs the specimen book in the space provided for this purpose
- In the space provided on the operating slip it is recorded that the specimen was sent to the laboratory. This information is also recorded in the operation register
- Every specimen carries the correct information to prevent a mix-up of specimen which may lead to a faulty diagnosis and treatment

#### ***1.2.2.5 Death Register***

There is no separate death register for OTs. Operation register is used to enter the event of death with red ink.

## 1.3. Visitors to the Operating Theatre

### 1.3.1 Introduction

The main objective of medical staff of OTs remains the creation of a safe environment, conducive to healing, and the protection of patient privacy and integrity. Allowing unauthorized people into this environment will violate this responsibility. The anaesthetized patient depends on the care giver to protect him/her against such intrusion of privacy, not authorized by him/her.

### 1.3.2 Definition

Visitors to the OT include all people not forming part of the medical and nursing team allocated to the specific procedure at the allocated time.

#### 1.3.2.1 Objectives

- To protect the patients privacy;
- To restrain the entering of unauthorized people into the OT;
- To ensure that the patient has given informed consent for the presence of the visitor;
- To establish a guideline for visitors to the OT.

#### *2.3.2.2 Recommendations regarding Visitors to the Operating Theatre*

Medical representatives are only allowed into the OT if they are there to demonstrate operating equipment, medical devices or loan instruments. All medical representatives (for example sales representatives of medical equipment/devices and pharmaceutical products) report to the theatre manager for permission to enter the OT.

- a) Medical representatives enter the sterile field only after they have gowned and gloved correctly under the supervision of scrub nurse
- b) The medical representatives enter the OT on the scrub nurse instructions after the patient has been cleaned and draped
- c) The medical representatives are informed of areas where they may enter and attend to the procedure

- d) Medical representatives guides and advises the scrub nurse and surgeon on use, assembling and sequence of use of instruments and implants but does not work directly with the patient
- e) Family members are not allowed to watch or be present at any surgical procedure
- f) A mentor accompanies medical students and the level of study is determined prior to entering the OT

#### ***1.3.2.3. During a Caesarean Section***

##### **If the father requests to be present during the procedure:**

At present we do not allow father to enter OT during caesarean section

#### ***1.3.2.4. Parents***

- Parents accompanies young children only till OT waiting area
- Parents do not enter the OT



## 1.4.1 Risks in the Operating Theatre which can Lead to Possible Law Suits

### 1.4.2 Identification

Insufficient identification as a result of:

- Not checking the patients name verbally and comparing it with that on the case paper. we avoid the usage of first names
- Incomplete full name and surname
- Absence and incomplete file entry, name, registration number and procedure
- Not indicating the correct side which needs to be operated on – left or right
- Allergies
- Baby born through caesarean – Absence of wrist band in theatre on arm and leg
- We use hand-band only in case of labour patient and the baby of parturient

### 1.4.3 Permission

No operation or procedure in the theatre is performed without a valid informed consent. If this happens the case can be reported as assault. Written informed consent is mandatory.

- An informed consent is signed for both the operation and the anaesthesia
- Permission is given voluntarily and with full insight
- The doctor gives the patient a full and comprehensive account of what will be done, the consequences thereof and the risks involved
- The patient is fully conscious and is not under the influence of any medicines. The patient signs before the administering of any pre-medication
- The consent form clearly states:
  - The name of the patient
  - The type of operative procedure or surgical performance
  - The date
  - Type of anaesthesia
  - Possible risks of surgery and anaesthesia

### 1.4.4. Surgical Asepsis

Sterility and maintenance of a high standard of aseptic techniques are of primary importance. Hygiene of the surroundings is maintained at all times.

#### Personnel

A high standard of personal hygiene is expected and each staff member maintains a high standard of sterile technique. The nurse in-charge makes sure that nursing staff do not always work under pressure and stress. The organization of the operating section is such, that precautionary measures are possible for all patients, even if an extremely heavy burden is placed on the staff. Suturing material, syringes and instruments are kept sterile. The autoclave is kept in working condition and serviced regularly (refer to the CSSD Guidelines). The cleaning of the theatre after a septic case and the day's operating schedule is essentially done.

### 1.4.5. Checking of Instruments, Swabs and Needles

Strict control over instruments, swabs and needles is necessary. The scrub nurse ensures that the tally of all instruments, swabs and needles is correct. If the tally is not correct, s/he informs the surgeon. If the surgeon is told that the tally is short or missing the medical devices issued, and continues to close the wound, he or she is held responsible. A written report is done if a swab, instrument or needle be missing.

### 1.4.6 Assistance during Operation

In case of emergencies, a nurse assists if a second surgeon is not available. BUT s/he changes her role to an assistant and do not hand the instruments to the surgeon and count the swabs. If a nurse assists in an operation, s/he writes an incident report to the accounting officer of the hospital. Nurses do not assist during an illegal operation, for example an illegal abortion, or s/he is regarded as an accomplice.

### 1.4.7 Keeping of Reports

Full reports of every operation are kept, for example:

- Full name and surname of patient
- Date of operation
- Initials and surname of surgeon and assistant
- Anaesthesiologist – initials and surname and type of anaesthesia administered
- Operation done, amount of swabs used, drainage tubes, suturing material and catheters used
- Nurse who assisted during operations – initials and surname
- Circulating (runner) nurse – initials and surname
- Time – beginning to end of anaesthesia

This report may be needed for medico-legal cases. It is therefore essential that it is at all times complete.

### 1.4.8 Injuries

Members of OT staff, and or patients might sustain injuries during an operating session. These are to be considered as injury on duty for the staff and as medical negligence for the patient following proper investigations. All records are kept of the incident. Some examples are shown below.

#### 1.4.8.1. Burns

- Theatre lights without heat shields
- Warm instruments, for example wound hook
- Rinsing water used in the peritoneal cavity
- Faulty diathermy machine and plate
- Neglect to use the foam rubber mattress
- Incorrect use of electric blanket or warm water bottle
- Strong chemical solution for the preparation of the skin or cleaning purposes
- Shoulder supports incorrect or in a faulty position
- Injury of the healthy part of the body next to or near to the wounded part, for example the tongue during a tonsillectomy operation, or injury to the face or nerves during a mastoidectomy

#### **1.4.8.2 Fall**

An unconscious patient can easily fall off an operating table or trolley if there is no sufficient supervision and safety belts are not tied properly. We take proper precautions to avoid it.

#### **1.4.8.3 Position**

Injuries can occur because of faulty positioning:

- Nerve, vein and joint injuries because the feet are crossed
- Incorrect way of picking up the legs which are placed in a lithotomy position.

#### **1.4.8.4 Tourniquet**

Incorrect use could injure veins and nerves if:

- o A tourniquet is kept on too long
- o Neglect or forgetting to remove a tourniquet

The time span in which a tourniquet is used is recorded in the patients operating notes.

#### **1.4.8.5 Electric shock**

Faulty electric apparatus, for example diathermy machine and suction apparatus can cause electric shocks. Therefore electric apparatus are checked daily for loose wires or faulty conditions. All electric apparatus and supply are checked and maintained frequently by the electrical/ technical workshop.

#### **1.4.8.6 Apparatus**

Maintenance of all apparatus and equipment, for example the anaesthesia machine, operating table, monitors and defibrillator is done thoroughly and is ready before the operation commences.

#### **1.4.8.7. Other causes of injuries**

- Oxygen cylinders not fixed
- Sharp, dangerous objects within reach of patient
- Faulty instruments
- Swinging doors
- Slippery, wet floors
- Splints
- Faulty respirators

#### **1.4.8.8. Explosions**

Flammable and volatile anaesthetic agents, such as ether, if used without due care and inadequate ventilation may explode or combust, causing serious injury. Diathermy is not used where open anaesthetic gases are being administered.

#### **1.4.8.8.1 Precautionary Measures**

- Anaesthesiologist must give permission for the use of diathermy and other electrical equipment
- Oxygen cylinders are in stands to prevent them from falling over
- No open flames are allowed in the theatre
- Prevent the build-up of static electricity. We make sure the air conditioner works efficiently
- No one is allowed to smoke in the OT
- Prescribed clothes only are worn at all times

#### ***1.4.8.9. Mental (psychological) Injuries***

2. Irresponsible remarks in front of patients, especially during induction of anaesthesia.
3. Giving incorrect information.
4. Information to the press. Special permission is given by the patient as well as the medical superintendent for the issuing of medical and related information.

#### ***1.4.8.10. Violation of Privacy and Name***

- Disclosure of a patient's personal particulars
- Neglect of professional confidentiality
- Giving out information about a patient to a person whom it does not concern
- Indecent exposure or display of a patient

#### ***1.4.8.11. Care of Unconscious Patients***

An authorized person only guards the patient to avoid complications and administers intensive care to a patient during the recovery period. Death during the recovery period can take place due to improper care.

#### ***1.4.8.12 Blood***

Proper, precise identification of blood is done by means of checking the patient's name and file. Faulty blood transfusion can result in death. Unfavourable (adverse) reactions are reported immediately.

#### ***1.4.8.13 Resuscitation***

Equipments are at all times available and in a proper working condition, for example monitors, respirators, defibrillators, etc.

#### ***1.4.8.14. Medication***

- Strict control
- Check any allergies on the patient's chart, it is written in Pre-anaesthesia check-sheet

- “Medical Alert” on file must be clearly visible
- Cautious checking and control of strength of medication

#### ***1.4.8.15 Tissue specimen***

Missing or incorrectly marked specimen can have serious consequences both for the patient management and also medio-legal implications.

Foreign objects removed, for example a bullet, are stored, for a possible police investigation.

#### ***1.4.8.16 Accidents***

Accidents and injuries in the theatre are filled in the prescribed form and signed by the person who knows about the incident.

## **1.4 Central Sterile Services Department (CSSD)**

This section provides a summary of CSSD services and serves as a reminder. There is a separate CSSD Guideline which should be referred to for detailed information.

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# CHAPTER 2: THE PATIENT

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This section deals with the patient assessment, consent form for operation, and post-operative care.

## 2.1 Consent to an Operation

**The purpose of the consent is to:**

- 1) Protect the patient from unnecessary invasive procedures
- 2) Protect the surgeon and health facility from claims of an unauthorized operation or invasive procedure
- 3) Ensure that the patient makes an informed decision

### 2.1.1 General Recommendations

The attending doctor adequately explains to the patient in a clear and simple language the following:

- The proposed operation
- The purpose of the operation
- The nature of the operation
- The extent of the surgical procedure
- Potential risks and complications
- Expected outcome of the procedure proposed
- Other available treatment options and
- Pre-operative advice to the patient regarding diet, bathing, smoking and other factors that might affect the outcome of the operation.

**Note: Adequate translation is provided for patients with a language barrier.**

The anaesthesiologist also has a responsibility to inform the patient of the following:

- Any unfavourable reactions to medication or anaesthetic agent that may be given during the operation; and
- The risks of anaesthesia are explained without causing the patient undue stress.

**NOTE:**

- Written informed consent is necessary for any procedure that may possibly be injurious to the patient.
  - The patient has a right to withdraw his/her written consent prior to the operation if his/her determination to do so is a rational one. The surgeon is then notified and the patient is not taken to the OT.



### 2.1.2 Information that appears on the Consent Form

- The document contains patient's full name and surname, date of birth, age, sex and registration number
- The correct procedure to be performed as well as the type of anaesthesia to be administered e.g. general, local, spinal or epidural
- The patient or legal guardian's signature as well as in what capacity the legal guardian is signing, e.g. patient, mother, father, etc
- Signatures of the two witnesses of which one is a registered nurse/ doctor.
- Date and time when consent was obtained
- An illiterate person can give consent by means of a thumb print whereby the witness indicates if it is the right or left print. ***In case the patient uses the thumb print, the name is added in the print.***
- The patient signs before pre-medication is given and prior to going to the OT. It is an informed consent freely given without coercion
- The patient giving consent must be of legal age (eighteen years and older), mentally sound and competent
- A consent form is completed by one person only

**NOTE:** No surgical procedure is to be performed on a patient without a legal consent except in a life-threatening emergency situation. In a dire emergency consent is desired but not essential. In such a case the Medical Superintendent of the hospital is consulted and may give consent to an operation. **Surgical procedures done without patients consent give rise to legal suits in the courts of law.**

### 2.1.3 Persons not capable of signing their own consent

- A minor that is younger than 18 years
- A person who is mentally incompetent
- An unconscious or intoxicated/drunk person or after pre-medication was given

### 2.1.4 Persons capable of signing their own consent

- Persons who have reached the legal age of eighteen years and older, mentally sound and competent
- A married woman younger than eighteen years may sign her own consent Marriage makes her a major
- A minor illegitimate mother can give consent for her child, but not for herself.
- If sterilization is to be performed on a married woman, she can sign her own consent, but it is advisable to obtain the husband's signature and vice versa. There must be a police declaration signed by the couple

- In the case of an unconscious patient the doctor decides if an operation is necessary to save the patient's life. If the patient's life depends on an emergency operation, the medical superintendent of the hospital is consulted and can give approval for the necessary operation to be done

## 2.2 Pre-Operative Assessment

### 2.2.1 A Pre-anaesthetic Assessment

The pre-anaesthetic assessment provides information needed to:

- Select the type of anaesthesia to be administered and plan anaesthetic care
- Identify any medicine sensitivities
- Safely administer the appropriate anaesthetic and
- Enquire about any relevant medical history

The duties of the anaesthesiologist are listed below:

- An anaesthesiologist conducts the pre-anaesthetic assessment
- Anaesthesia care is carefully planned and documented in the anaesthesia record
- The plan considers information from other patient assessments and identifies the anaesthesia to be used, the method of administration, other medications and fluids, monitoring procedures, and the anticipated post-anaesthesia care
- The anaesthesia planning process includes educating the patient and his or her family or decision-maker regarding the risks, potential complications, and options related to the planned anaesthesia and post-operative analgesia. This discussion occurs as part of the process of obtaining consent for anaesthesia. The anaesthesiologist or the qualified individual who will administer the anaesthesia provides this education
- Since anaesthesia carries a high level of risk, its administration should be carefully planned. A pre-anaesthetic assessment should be conducted and recorded

### 2.2.2 When to carry out an Anaesthetic Assessment

- An anaesthetic assessment of a patient for elective surgery is performed a day before the anaesthesia is administered
- An anaesthetic assessment of a patient for emergency surgery is always done before the patient is taken to theatre
- The medical assessment of surgical patients is documented before the start of the anaesthesia
- Interpret and act on any abnormal findings (e.g. blood pressure, haemoglobin, blood glucose, etc.) of the patient

### 2.2.3 Other Requirements

The pre-operative assessment requires a clinical check up by the surgeon prior to the operation. The surgical team should ensure that the patient fully understands the procedure and that the consent form is signed (see above).

## 2.3 Reception of the Patient in the OT

The patient is taken to the OT on a patient trolley with side rails in position. The patient is accompanied by a nurse and a porter. At the reception area in the OT, the OT nurse receives the patient in a polite and friendly way.

The nurse escorting the patient gives his/her report to the receiving nurse and the information regarding the patient's identification and type of operation is checked. After handing over the patient, the escorting nurse signs on the **progress report**. The following is recommended:

- The person who receives the patient should introduce themselves to the patient and ask the patient for his/her name and what kind of operation they have come for
- Patients with chronic illnesses should be asked if they took their medications e.g. high blood pressure and diabetes treatment and how many hours prior to operation
- The condition of the infusion line is determined.
- Determine whether or not pre-operative dietary and fluid restrictions have been maintained. If not inform the anaesthesiologist. Aspiration for gastric contents during induction of anaesthesia is a danger
- If applicable, check whether the anatomical site of the operation is clearly spelt out
- Check whether the patients vital signs were taken prior to coming to theatre
- Ensure that the surgical safety check list is attached to the patients file

### 2.3.1 Pre-operative Check of Patient Particulars

#### 2.3.1.1. Identification of the patient

- The OT nurse checks the patient's identification wristband and records.
- Check with the patient, by asking what his/her name is
- Check at the same time on the arm band on the patient arm, the charts and the operation list, to ensure that it is the correct patient for the correct operation
- Check if the side rails or restraining straps are firmly in position

#### 2.3.1.2. Consent to an operation

The OT nurse who receives the patient from the ward ensures the following:

The patient has signed the operation consent

- The patient understands what the operation entails. Ask the patient what operation is to be performed and whether the doctor has explained the whole procedure
- The correct operative site is marked, especially where the operation is to be performed on an extremity or repair of inguinal hernia

**The operation consent is completed correctly, and signed by the patient, parent or legal guardian as well as the surgeon and the two witnesses.**

#### ***2.3.1.3 Cortisone treatment and other prescribed medications***

Check on the prescription as well as on the treatment chart if cortisone has been prescribed and any other medications that the anaesthesiologist should be aware of. If medications have been prescribed, the anaesthesiologist is informed accordingly.

#### ***2.3.1.4 Pre-medication***

Observe the patient's anxiety level. Check the patient's prescription and treatment charts to ensure that the prescribed pre-medication was administered, as well as the correct dosage at the correct time. Observe the patient for possible reaction to pre-medication. If the patient shows a reaction, it is immediately brought to the attention of the anaesthesiologist.

#### ***2.3.1.5 Allergies***

Check the medical history, physical examination, laboratory tests and x-ray reports. Pay particular attention to allergies and previous unfavourable reactions to anaesthesia, antimicrobial agents or blood transfusion.

#### ***2.3.1.6 Urine test***

If indicated, make sure that the urine was tested and if any abnormalities were detected and charted. Check whether an indwelling catheter is inserted. Check for proper drainage. Abnormalities in the urine are reported to the anaesthesiologist/surgeon.

#### ***2.3.1.7 Empty Bladder***

To prevent over distension of the bladder or incontinence during unconsciousness, check whether the patient has voided. The patient should void to empty the urinary bladder just before transfer to the OT. Time when patient last voided must be recorded. Most abdominal surgery will require a urinary catheter in place to ensure fluid balance checks.

#### ***2.3.1.8 Dentures***

Dentures and removable bridges are removed for general and local anaesthesia unless otherwise ordered by the anaesthesiologist. This is to prevent obstruction of respiration under anaesthesia. Prosthesis such as an eye, false teeth extremity, contact lenses and glasses are removed for safekeeping.

- All jewellery (*including wedding rings, body piercings, traditional body and head gear*) are removed for safekeeping
- If it is impossible to remove the wedding ring, it is securely taped or tied to the finger to prevent loss
- Nail polish is removed from the patient's finger and toes to permit observation of nail bed colour, an indication of oxygenation and circulation

## 2.3.2. Pre-operative Preparation

### 2.3.2.1 Skin preparation of the patient

The purpose of skin preparation is to render the operative site as free as possible from transient and resident micro-organisms, dirt, and skin oil so that the incision can be made through the skin with minimal danger of infection from this source.

Skin preparation: Ordinary bathing with soap and water prior to the operation removes excessive dirt and grim and make the patient feel better and more presentable for the operation.

In some situations, the surgeons will ask that the patient be bathed in 2% chlorhexidine, especially for implant surgery. This is provided by the healthcare facility and used the night before the operation.

Patients whose operations will be performed on the face, eye, ear, or neck are advised to shampoo their hair prior to hospital admission as this may not be permitted for a few weeks post-operatively.

All patients shower or take bath after hospital admission as close to the time of departure to the OT as possible. The operative site and surrounding area is thoroughly cleansed with a rapid-acting antiseptic agent such as povidone iodine, if requested by the surgeon. Usually skin preparation takes place in the Operating Theatre.

**NOTE: History of allergies must be obtained before applying any chemical agent to a patient's skin.**

### 2.3.2.2. Hair removal

Hair removal from the skin surrounding the operative site is necessary. Usually the surgeon is responsible for designating in the patient's pre-operative order the limits of the skin area and how it is to be prepared. The procedure is carried out by nursing personnel, as per hospital policy and should be done in the ward prior to moving the patient to the operating theatre.

**NOTE: Skin preparation may be an embarrassing procedure for the patient. Drape the patient to expose the area to be prepared, but avoid unnecessary exposure.**

**Hair may be removed by shaving with clippers or application of a depilatory cream after a skin test has been done to determine allergy. RAZORS AND SHAVING IS NOT RECOMMENDED.**

### **2.3.2.3. Nil per mouth**

Oral intake is discontinued as ordered, usually nothing by mouth/Nil per Os (NPO) for 8 hours preceding the operation, to prevent regurgitation or emesis and aspiration of gastric contents. This instruction is also given to ambulatory surgery patients to follow at home.

The nurse reviews the orders and nursing care plan. She/he asks the patient if he or she has taken anything by mouth, if NPO order was written to prevent aspiration.

**NOTE: If the patient is a smoker, s/he is not allowed to smoke prior to the operation. If the patient had something to eat or to drink just before transportation to the operating theatre, the anaesthesiologist is informed immediately.**

- Depending on the patient's condition, the surgeon may postpone the operation to a later date, as anaesthesia would be hazardous
- In cases of emergency where the patient was not kept nil per mouth, a nasogastric tube is passed on orders of the surgeon, otherwise anaesthesia may be hazardous
- The form is then signed by the ward nurse as well as the OT nurse
- The patient is now taken to the waiting area and never left alone. The patient is made comfortable and continuously observed by the nurse allocated to the waiting room
- The patient is not to be disturbed by unnecessary conversation etc. A quiet, restful atmosphere enables the patient to gain full advantage of pre-medication

## **2.4. Monitoring and Recording the Physiological Status**

### **2.4.1. During Anaesthesia and Surgery**

- Each patient's physiological status is monitored and recorded during anaesthesia and surgery
- The anaesthesiologist monitors and records the physiological status of the patient during anaesthesia, and enters the anaesthetic, medication and intravenous fluids used in the patient's anaesthetic record
- The anaesthesiologist should have access to the patient care notes and know the findings of the medical examination. It is important that each health professional has access to the records of other care providers, in accordance with the MoHSS healthcare facility policies and guidelines

### 2.4.2 Monitoring and Recording of the Patient's Post-anaesthetic Status

Each patient's post-anaesthetic status is monitored, and the patient is discharged from the recovery area in accordance with accepted guidelines. Physiological monitoring provides reliable information about the patient's status during the administration of anaesthesia and the recovery period.

Monitoring methods depend on the patient's pre-anaesthetic status, anaesthetic choice, and the complexity of the surgical or other procedure performed during anaesthesia. In all cases, however, the monitoring process is continuous, and the results are entered into the patient's record. Monitoring during anaesthesia provides the basis for monitoring during the post-anaesthetic recovery period. The ongoing, systematic collection and analysis of data on the patient's status in recovery may support decisions about moving the patient to other settings and less intensive services.

Only a suitably qualified and experienced registered nurse or designated member of the medical staff carries out monitoring in the recovery area. Recording of monitoring data provides the documentation to support discharge decisions. The anaesthesiologist decides whether the patient can be discharged from the recovery area to another level of care or from the organisation (as in the case of ambulatory anaesthesia).

Standardized criteria developed by medical personnel are used to make discharge decisions.

**The following is recommended:**

- During the post-anaesthetic recovery period, patients must receive monitoring appropriate to their condition
- Monitoring findings are entered in the patient's record
- Established criteria are used to make decisions regarding the patient's discharge from the recovery room
- The decision to discharge the patient is recorded
- Recovery area arrival and discharge times are recorded
- The signatures of those handing over and those receiving the patient are recorded

# CHAPTER 3: STAFF CONDUCT AND PRACTICE

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## 3.1 Orientation of New Personnel and In-Service Training

### 3.1.1. Purpose

To ensure that the new personnel are well oriented and health care workers (HCWs) keep up with all the latest developments in their occupation so as to provide quality health care services.

### 3.1.2 Orientation of New Staff Members

All new staff members are introduced to the operating theatre on the first day or as soon as possible to familiarize themselves in the new and unknown surrounding. Every member of the health facility is oriented including staff members from Health Centres and Clinics.

This gives the new staff members' confidence as they familiarize themselves with the operating theatre.

During orientation, the head nurse informs the new staff members about the policy of the institution in order for them to know what is expected from them.

Work schedules are drafted and new staff members are informed accordingly.

### 3.1.3 In-service Training

- The operation theatre has a regular in-service training programme.
- In-service training in the form of discussions, demonstrations with regard to procedures and methods can be done by the more senior staff members. It is important that everyone participate in the in-service training activities.
- The medical – legal risks in the operating theatre and recovery room are emphasised time and again.
- We Organize an in – service training programme for domestic personnel as well. It is equally important that they must know how to clean and the importance thereof.
- The necessary training material is provided.

## 3.2 OT Attire

### 3.2.1 Purpose

The primary purpose of operating theatre attire is to instil a sense of discipline in those working in the operating theatre, and to identify the operating theatre as a separate clean area. It is also to ensure that clean clothes are worn when operating on the patient to prevent harmful bacteria.



## Definition and Categories

Upon arrival in the operating theatre suite, ALL personnel working in the OT changes out of their street clothes and into theatre attire. Those that work in the OT but are not part of the scrub team do not need to wear anything more than head cover. Those working in the OT and are part of the scrub team including working in the layup area will wear:

- Head cover
- Plastic apron
- Surgical mask

Additionally, those involved directly in the operation procedure also wear eye protection to avoid splashing. Sterile gown and gloves are added for scrubbed team members.

The protective gear prevents exposure to blood and body fluids for the scrub team and support teams, but it also helps to reduce bacterial contamination via shedding of skin scales.

## 3.3 General Considerations

1. Each OT should has a specific complete written policy or standard operating procedures on proper attire that is known to all persons
2. Only approved, clean OT attire is worn within the restricted area of the OT suite. Street clothes are never to be worn within the restricted area. **This regulation applies to anyone entering the restricted area**
3. Ideally, OT attire is not worn outside the OT suite. However, if they are, then an over-gown and CHANGE OF FOOTWEAR is recommended. Overshoes are not recommended.
4. Dressing rooms located adjacent to the OT suite are reached through the outer corridor.
5. Comfortable supportive shoes are worn to relieve fatigue
6. Proper personal hygiene is re-emphasized
7. No person with an acute infection, such as a cold or sore throat, or skin lesion, such as a furuncle or any contagious condition, is permitted within the OT
8. Persons with cuts, burns, or skin abrasions do not scrub or handle sterile equipment as this may increase the risk of infection to the patient

## 3.4. Components of Attire

Each item of OT attire is a specific means of protecting the patient from the sources of contamination and risk of infection.

### 3.4.1 Body Cover

A variety of scrub suits and dresses are available and most of them are usually made of cotton which is absorbent, breathes easily and can be washed at high temperatures. Disadvantages of cotton is that there is no barrier against wet splashes or contact, is absorbent and therefore will require a water resistant apron underneath the sterile cotton gown if operating.

- Dresses are wraparound style to facilitate easy removal
- Scrub shirts and waistline are tucked inside the pants to avoid it from touching sterile areas
- Any other clothes for example vests are not allowed to be put under the scrub shirts

### 3.4.2. Surgical Mask

A surgical mask is recommended for the scrub team working inside the OT suite. It is worn to contain and filter out droplets containing micro-organisms expelled from the oral and nasopharynx. During talking, sneezing, and coughing organism laden droplet nuclei are dispersed, but this breaks the barrier because of the moisture in the breath and it is reported that a surgical mask is effective for a short period of time. Therefore the surgical mask must be changed between each patient. The mask is designed for close fit but improper application can negate their efficiency.

Always tie the strings tightly, to prevent the string coming loose during an operation and contaminating the sterile gown. The upper strings are tied at the back of the head, and the lower strings behind the neck.

The surgical masks have an exterior pliable strip or noseband that can be bent to contour the mask over the bridge of the nose (refer to the IPC Guideline Chapter 4).

### 3.4.3 Head Cover

All facial and head hair must be covered in the restricted area. Practically all head covers are disposable and made of lint-free nonporous, soft, cloth-like fabric. If hair is long, a helmet or hood must be worn to cover the neck area. Headgear is worn well to prevent any escape of hair and to confine micro-organisms. A cap or hood is put on before a scrub suit or dress to protect the garment from contamination by hair.

### 3.4.4 Eye Protection: Goggles and Face Shields

Eye protection is worn as part of personal protective equipment to act as a barrier to infectious material entering the eye during all invasive surgical procedures, including endoscopic procedures, or in any situation where splash injury to the eyes could occur.

Eye protection is comfortable to allow for sufficient peripheral vision, and is adjustable to ensure a secure fit. For none disposable eyewear, it is recommended that each individual be provided his/her own eyewear that is only

worn by that person in order to ensure the appropriate fit is maintained and minimize the potential of exposure to the wearer.

Eye protection is removed in an aseptic manner to minimize splashes of blood and body fluids to the mucous membrane, in particular the conjunctiva of the eye. Eye protection should be removed and not carried outside of the surgery department. After the use of the goggles and face shields cleaning should be done according to the manufactures recommendations.

### 3.4.5 Appropriate Operation Room Shoes and Shoe Covers

Appropriate operation room footwear i.e slippers are to be worn at all times in the restricted area. **Overshoes are not recommended.**

### 3.4.6 Gown

Sterile cotton gowns are worn over scrub attire to permit the wearer to create and to come within the sterile field, in order to carry out a sterile technique during an operative procedure. Since these are made of cotton, a plastic apron should be worn underneath it. Although the entire gown is sterilized, the back is not considered sterile nor is any area below waist level, once the gown is donned. Wrap around gowns that provide sterile coverage to the back by generous overlap are recommended. The cuffs of gowns are rib-knit to tightly fit the wrist.

### 3.4.7 Gloves

Sterile gloves complete the attire for scrubbed team members. They are worn to permit the wearer to handle sterile supplies or tissues of the operative wound.

Glove packages are generally the peel-apart type. Prior to opening the package, the circulating nurse inspects for the following:

- Expiry date of the gloves. Expired gloves are never used.
- Damages or wetness which would indicate contamination.

When the inner paper is unfolded, the wearer puts the right glove to the right, the left glove to the left, palm side up. If a sterile glove is punctured or torn it must be changed immediately to prevent escape of micro-organisms from the skin beneath.

## 3.5 Principles of Aseptic Technique

We observe sterile techniques in order to prevent the risk of infection.

**The following is recommended:**

1. Only sterile items are used within a sterile field. If you are in doubt about the sterility of anything, consider it not sterile.

2. Gowns are considered sterile only from the waist to shoulder level in front, and the sleeves.

***The following practices are observed:***

- Scrub team keeps hands in sight and at or above waist level.
  - Hands are kept away from the face and elbows close to one's sides. Arms are never folded because there may be perspiration in the axillary region.
  - Items dropped below waist level are considered unsterile, and are discarded.
3. Mayo tables and trolleys are sterile only at table level. Only the top of the sterile draped table is considered sterile. The edges and sides of the drape extending below table level are considered unsterile.
    - Anything falling over or extending over the table edge, such as a piece of suture, is unsterile.
    - In unfolding a sterile drape, care is taken that the part that drops below the table surface is not brought back up to table level.
  4. Persons who are sterile touch only sterile items or areas; persons who are not sterile touch only unsterile items or areas, for example:
    - The sterile team members maintain contact with the sterile field by means of sterile gowns and gloves.
    - The circulating nurse does not directly contact the sterile field.

Supplies for sterile team members reach them by means of the circulating nurse opening the items on the sterile field.

### **3.6. The Need for Sterile Technique**

Strict aseptic and sterile techniques are needed at all times in the OT, because freshly incised or traumatized tissue can easily become infected. Therefore, anything unsterile in contact with the patient is potentially dangerous and can transfer microbes into the open wound. All operative procedures are performed under sterile conditions.

Conversely, terminal decontamination and sterilization of all material and equipment used during an operation is performed with the assumption that every patient is a potential source of infection for other persons.

It is essential that all members of the operating team know the common sources of contamination by micro-organisms in the OT, and the means by which they reach the sterile field and operative wound. Maintaining the sterile technique is the responsibility of everyone caring for the patient in the OT.

## 3.7. Surgical Scrub

### Definition

The surgical scrub is the process of removing as many micro-organisms as possible from the hands and arms by **mechanical washing and chemical antiseptics** before participating in an operative procedure.

### Mechanical and Chemical Antiseptics Washing

#### Purpose

The purpose of the surgical scrub is to remove soil, debris, natural skin oils, hand lotions, and micro-organisms from the hands and forearms of sterile team members. The surgical scrub is done just prior to gowning and gloving for each operation.

#### Hand washing facilities

Adequate scrubbing and hand washing facilities is provided for all operating team members. Preferably, taps are hand sensor or foot operated.

The sink is designed deep and wide enough to prevent splashing. A sterile gown cannot be put on over damp scrub attire without resulting in contamination of the gown by moisture oozing through. Scrub sinks are used only for scrubbing or hand washing. They are not to be used to clean or rinse contaminated instruments or equipment.

For safety and convenience, the scrub room is adjacent to the OT.

### 3.7.1 Preparation for Surgical Scrub

#### General preparation

- Fingernails are well trimmed to avoid glove puncture.
- Skin and nails are kept clean and in good condition. If hand lotion is used to protect skin, a non-oil base product is recommended.

No nail polish and artificial nails are allowed. The nail polish may chip and peel thereby providing a harbour for micro-organisms in cracks.

#### Preparations prior to scrub

1. Inspect hands for cuts and abrasions.
2. All jewellery on the fingers, wrists and arms are removed. Jewellery harbours micro-organisms. It can also be a potential foreign body in the operative wound.
3. All hair is well covered by headgear.
4. Adjust disposable mask snugly and comfortably over nose and mouth.

5. Eyeglasses and protective glasses are adjusted comfortably in relation to mask.
6. Adjust water to a comfortable temperature.
7. A wall clock is available.

### 3.7.2. Surgical Scrub Procedure

- The surgical scrub takes three minutes. We use the clock in the OT or in the scrub room to check/ control the scrub.
- To prevent contamination from the elbows and arms to the hands, the hands are always be kept above elbow level.
- The scrub procedure takes place under running tap water.
- Wet hands and arms properly.
- Apply antiseptic hand scrub or soap such as chlorhexidine or povidone iodine to the hands and rub the hands together for one minute. Rinse in between. Also wash in between fingers
- Wash arms to above elbows for one minute
- Rinse hands and take fresh soap/scrub solution
- Rinse from fingertips to elbows. Always keep hands above elbow level.

#### **Drying of hands and arms**

After scrubbing, hands and arms are thoroughly dried before the sterile gown is donned to prevent contamination of the gown by strike through of organisms from skin and scrub attire. Two huckaback or disposable paper towels are placed on top of the gown during packaging for drying of hands.

- The circulating floor nurse opens the outer layer of the gown pack. Stand way from the trolley. Water does not drip on the trolley
- The scrub-nurse takes one huckaback or disposable paper towel in the (R) hand and start drying the fingers, hand and arm up to the elbow of the (L) side. Keep away from the body. We do not go back touching or drying the fingers
- Surgeon/s follows same procedures as the scrubbing nurse/s
- Now take the second huckaback or disposable paper towel in the (L) hand and dry the (R) side in the same manner as the left side

**NOTE:** During and after scrubbing, keep the hands higher than the elbows to allow water to flow from the cleanest area, the hands, to the marginal area of the upper arms.

### 3.8. Gowning Technique

The sterile gown is put on immediately after the surgical scrub. The sterile gloves are put on immediately after gowning.

## **Purpose**

Sterile gown and gloves are worn to exclude skin as a possible contaminant and to create a barrier between sterile and unsterile areas. We make sure there is adequate space to put on the gown without touching non sterile surfaces.

The following is recommended during the process of gowning:

- Reach down to the sterile package and lift the folded gown directly upward.
- Step back away from the table, into an unobstructed area, to provide a wide margin of safety while gowning
- Holding the folded gown, carefully locate the neckband.
- Holding the inside front of the gown just below the neckband with both hands, let the gown unfold, or fall open away from the trolley keeping the inside of the gown toward the body. We do not touch the outside of the gown with bare hands.
- Examine the gown for holes and tears. If the gown is torn, do not use it, get a new one
- Holding the hands at shoulder level, slip both arms into the armholes simultaneously

The circulating floor nurse brings the gown over the shoulders by reaching inside to the shoulder and arm seams. She securely ties or fastens the back of the gown at the neck.

## **3.9. Gloving Technique**

The following is recommended:

1. With the left hand, grasp the cuff of the right glove on the fold. Pick up the glove and step back from the table. Look behind you before moving
2. Insert the right hand into the glove and pull it on, leaving the cuff turned well down over the hand
3. Slip the fingers of the gloved right hand under the everted cuff of the left glove. Pick up the glove and step back
4. Insert the hand into the left glove and pull it on, leaving the cuff turned down over the hand
5. With the fingers of the right hand, pull the cuff of the left glove over the cuff of the left sleeve. If the stockinet is not tight, fold a pleat, holding it with the right thumb while pulling the glove over the cuff. Avoid touching the bare wrist.
6. Repeat step 5 for the right cuff, using the left hand, and thereby completely gloving the right hand

### 3.10 Removing Gown and Gloves

- The gloves sit on top of the cuffs of the gown and therefore have to be removed in order for the gown to be taken off
- Gloves are rolled off the hand by turning them inside out as they are removed and discarded into a container for disposable items. We never snap gloves
- The gown is untied from the back and pulled downward from the shoulders, turning the sleeve inside out as it is pulled off the arms
- We put the used gowns in a linen container



# CHAPTER 4: SURGICAL EQUIPMENT

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## 4.1 Surgical Instruments and Packs

- Surgical instruments come in different variations in structure and design to meet a particular purpose and have specific requirements.
- Surgical instruments are valuable tools and need to be respected and handled with care.
- Surgical instruments should be purchased from reputable manufactures that have high standards concerning pattern, material and workmanship.

### 4.1.1 Management of Surgical Instruments

For an effective surgical instrument management and control programme, the nursing staff knows the following:

- The instrument inventory.
- The routine instruments needed for each type of operation
- The correct use and handling of instruments
- The method of instrument processing or preparation e.g. sterilisation
- The aftercare of the instruments and
- The individual surgeon's preferences

### 4.1.2. Recommendations in Relation to the Handling and Caring of Instruments

1. We inspect each instrument before and after use to detect imperfections. An instrument or appliance should function perfectly to prevent needless endangering of a patient's life and increasing the operative time because of failure of an instrument.
2. We set aside damaged instruments and send them for repair or replacement promptly.
3. We use instruments only for the purpose for which they are designed. Proper use prolongs their life. Fine clamps and dissecting scissors can be forced out of alignment, cracked, or broken if they are used on heavy tissue, gauze dressings or drainage tubing.
4. We handle instruments gently at all times and avoid bunching, dropping and weighing them down under heavy pieces of equipment.
5. We provide protection for cutting instruments, lensed instruments, and fine, delicate holding instruments that are unusually susceptible to damage by using specially designed racks and cases.

6. We clean instruments meticulously. Make sure instruments, are perfectly clean and dry before storage.
7. Oil is kept away from instruments. Oil forms a bacterial protecting film that is difficult and time consuming to remove and it also interferes with steam penetration during the sterilization process, except for silicone instrument spray that can be used for stiff or rusty instruments. The silicone must be removed before sterilization.
8. We give instruments for regular maintenance e.g. such as sharpening of scissors.
  9. We take inventory at periodic intervals during the year e.g. every 3 or 6 months. Shelved instruments are limited.
  10. All newly received instruments are marked with a special instrument marker before being put into use.
  11. We check for expiry date regularly but at least monthly.
  12. We rotate sterile instruments in order to use item according to expiring date (First in, first out - FIFO).
  13. Sterile packs are stored up to the expiry date after which it is returned to the CSSD for repackaging and sterilization.

#### **4.1.3. Handling of Instruments during Surgery**

1. The scrub nurse, who takes care of an operative procedure, is responsible for the instruments. All instruments are checked and counted by the scrub nurse together with the circulating nurse before commencement of surgery. Artery forceps and clamps are packed in standard figures of 5 or 10 and counted, as well as detachable parts such as screws and blades of retractors
  - It is important that all instruments are counted particularly when surgery is to be performed in a cavity such as the abdominal, thoracic and pelvic cavities, extra peritoneal space, vagina, and hip or shoulder joints and along the spine
  - Each item is considered a foreign object that can cause unnecessary harm should it be left inside the patient. Therefore, to ensure adequate patient protection, these items are counted before and after use. A counting procedure is a method of accounting for items put on the sterile table for use during an operation
  - In the operation theatre the scrub nurse counts the instruments, big swabs, and small swabs in front of the surgeon in the beginning and at the end of the surgery.

All instruments are again counted before closure of peritoneum. The scrub nurse must inform the surgeon accordingly. The scrub nurse and the circulating nurse sign their names on the instrument list as well as the date when used.

2. Instruments are arranged in an orderly basic manner on the mayo table to facilitate checking and counting. We do not overload the mayo table initially. Additional instruments and supplies are added as the operation progresses

3. We never leave instruments on the patient, especially a scalpel handle with blade. It injures the patient. We always work from the mayo table or instrument trolley
4. The diathermy point is kept away from the patient to avoid causing a diathermy burn
5. Instruments are handled gently and with respect. It is the responsibility of the scrub nurse to see that the instruments are being used correctly by the surgeon and the assistant
6. It is ensured that all instruments handed to the surgeon are in perfect working condition
7. All instruments falling from the operative field are hung on the swab rack. In case an instrument is needed for surgery, it is first be cleaned and then sterilized with the approval of the scrub nurse
8. Under no circumstances any instrument is removed from the OT during surgery
9. The tip of an instrument during surgery is never touched.
10. The scrub nurse informs the surgeon aloud regarding the instrument as well as the swab count after checking
11. After counting, all instruments are fastened with instrument pins
12. All blades used during surgery are removed from the handles, counted and thrown directly in a safety box or sharps container

## **4.2 Sterile Instruments**

The following is recommended:

- a) The sterile storeroom is spacious with as many shelves as possible. The shelves are free-standing from the walls, which permit supplies to be put into one side and removed from the other, thus older dated sets and packages are always used first.
- b) The shelves and open racks are damp dusted at least once a week and the floors are mopped daily. These cleaning duties are performed over a week-end when surgery is minimized to emergency cases only.

Shelves are marked clearly. Instrument sets and the various other packs are placed sorted of a kind on the shelves. It facilitates the duties of the personnel and they will exactly know where a certain item is placed, as well as to facilitate orientation of new personnel.

- c) Torn wrapping of instrument sets and packs are unsterile and are re-wrapped and re-sterilized.
- d) Check expired dates on all sets and packs routinely e.g. every four days.
- e) Packs are rotated daily; that means older dated packs are used first (FIFO).
- f) Instrument sets, linen and basin packs have a shelf life of six months if the wrapping is still intact, otherwise it is re-sterilized.
- g) Single or loose packed instruments or items wrapped in mediplast pouches have a shelf life of six months if wrapping is still intact.
- h) Some items deteriorate with repeated sterilization
  - Many items are seldom used yet several must be kept sterile at all times. Older supplies are always used first so that they do not become outdated. Commercially sterilized packages usually have manufacturer's expiry date on the package. Check and return to the pharmacy/clinical supply at least two to three months prior to the expiry date

## 4.3 Special Instruments

### 4.3.1 Lensed Instruments

Just to summarize, lensed instruments are protected from breakage and distortion. Each instrument is kept straight at all times when not in use. Flexible endoscopes such as the gastroscope are never bent except during introduction into a passage within the patient. The junction of the flexible and rigid portions of the scope is the most vulnerable point. When a telescopic scope is sent for repair, it is wrapped gently and placed within a padded carton to protect the lens during transportation.

#### **General precaution for the care of lensed equipment such as endoscopy and urological instruments which we follow are:**

1. Do not boil or autoclave instruments containing lamps or lenses
2. Do not place lensed instruments in solvent solutions such as alcohol
3. Never handle lensed instruments with forceps. A scratch on the instrument could cause injury to tissue or the mucous membrane lining of an orifice. Also the danger of dropping the instrument is greatly increased. The forceps could crush a telescope and ruin the optical system if held too tightly. Always handle sterile instruments wearing sterile gloves.
4. Never pile these delicate instruments one on top of another or mix them with other instruments

5. Avoid rough handling, jarring, or bending of parts. Lay them on a towel to absorb the impact and to prevent wear on the sheath
6. Check the light source for working order before use and after cleansing

Thorough cleaning in clear tap water and mild soap solution is the first step toward decontamination. Special attention is given to surface joints and revises that may retain mucus. The lumen of every hollow instrument requires special attention. Thorough rinsing immediately after use is the best precaution to prevent clotting and crushing of blood and body fluids in the instruments.

The endoscope is soaked in 2% Glutaraldehyde for 15 minutes after it has been thoroughly cleaned. Then it is removed and rinsed several times in clean or sterile water before being introduced in to a patient. The protocol for endoscopic decontamination is followed.

#### **4.3.2 Sharp or Semi-sharp Instruments**

- We protect the edges of sharp instruments such as scissors, knives, osteotomes, Chisels, etc. during cleaning, sterilization and storage
- Sharp instruments are kept separate from blunt ones and they demand respectful handling

#### **4.3.3 Micro-surgical and Ophthalmic Instruments**

- Each delicate instrument is separated from adjacent ones to prevent interlocking or crushing. We never pile them on top of each other or they are easily deformed
- Exact alignment of the teeth is an absolute necessity in fine – toothed forceps. The microscopic teeth are very easily bent
- We place instruments on a firm, flat surface for sorting and cleaning
- Sharp blades and tips should touch absolutely nothing, not even a towel. They must never touch another instrument or any part of a receptacle in which they are placed for storage or sterilization

#### **4.3.4 Air-powered Instruments**

- It is ascertained that air exhausts are directed away from the sterile field
- We follow instructions for use, care and sterilization recommended by the manufacturer
- Test instruments for working condition before surgeon is ready to use

### 4.3.5 Electrical Instruments

- Electrical powered instruments, such as saws, drills, dermatomes etc., are potential explosion hazards in the OT. Most motors are designed to be explosion proof. All must have spark proof connections. However, power switches should be off when plugging electrical cords into outlets
- We alert the anaesthesiologist if electrical equipment will be used. He may change the anaesthesia to eliminate explosive gases
- We do not immerse motor in liquid
- We follow the manufacturer's recommended methods of cleaning, lubricating, sterilizing and using each piece of electrically powered equipment
- Power cords and plugs are checked for cracks or breaks and tested for working condition before surgeon is ready to use instrument and the device is applied to the patient

### 4.4 Linen and the Disposable Draping Material

The use of linen in the OTs has significantly reduced since the introduction of disposable patient paper drapes in most of the hospitals. Woven linen has been found to cause "sterile" or non-microbial wound infections due to the lint and the fibres which settle in the wound and cause infection. Linen is however still being used in respect to OT attire, patient gowns, sheets, blankets and is responsible for an increased number of surgical site infections.

#### 4.4.1 General Considerations in the Usage of Linen

- All linen is washed and cleansed
- Linen is free from holes and tears
- All old and torn linen is sent back to the laundry to be repaired as well as a requisition for replacement
- We keep record of linen. It is only used for what it is designed for.
- Linen is at least checked once a month and recorded in the inventory register
- Loss of linen is reported to the person in charge immediately
- We make sure that there is always sufficient linen in stock

**NOTE: A control mechanism (standard operating procedures) should be in place in theatre regarding the management of linen.**

#### 4.4.2 Care and Handling of Clean Linen

- All linen is kept in a linen room when not in use
- Shelves are always kept neat and tidy
- Clean and dirty linen is not kept in the same place

- The linen room is kept under lock and key when not used and the key kept by the person in charge

## 4.5 Disposable Patient Paper Drapes

The precautions for draping with the paper drapes are the same as for linen and are strictly adhered to.

### **Advantages of non-woven fabrics/ paper drapes**

- a) Moisture repellence retards blood and aqueous fluid moisture strike-through to prevent contamination
- b) Lightweight, yet strong enough to resist tears
- c) Lint-free
- d) Contaminants are disposed along with drapes
- e) Antistatic
- f) Pre-packed by the manufacturer. This eliminates the washing, mending and folding processes. Some drapes contain a layer impermeable to ooze or filter – through. Less drapes are being used, thus no over draping of the patients - and are cost saving

### **NOTE:**

- Keep in mind that the paper drape does not feel the same as the linen drape that you are used to
- In the beginning difficulty with the manageability of the drapes may be experienced
- Be careful not to place sharp instruments for example a scalpel on the patient drape. The blade can easily cut through the drape and injure the patient

## 4.6 Draping

Draping is the procedure of covering the patient and surrounding areas with a sterile barrier to create and maintain an adequate sterile field during the operation. An effective barrier eliminates the passage of micro-organisms between non-sterile and sterile areas.

### ***Techniques to remember in draping***

Since draping is a very important step in preparation of the patient for operation, drapes must be packed correctly and in sequence on the instrument trolley beforehand.

The scrub nurse as well as the entire team is familiar with the draping procedure.

1. We place the drapes on a dry area. The area around or under the patient may become damp from the solutions used for skin preparation. The circulating nurse removes damp items or covers the area to provide a dry field on which to lay the sterile drapes
2. We allow sufficient time to permit careful application
3. We allow sufficient space to observe sterile technique
4. We handle the drapes also as little as possible
5. We never reach across the operating table to the drape or go around the table to drape the opposite side. An Assistant is taken for to help.
6. We take the drapes and trowel clips to the side of the table on the instrument trolley
7. We carry the folded drapes to the operating table. Watch the front of the sterile gown; it may bulge and touch the unsterile table or blanket on the patient. We stand well back from the unsterile table
8. We hold the drapes high enough to avoid touching the overhead operating light.
9. We hold the drape high until it is directly over the proper area, and then lay it down where it is to remain. Once the drape is placed, we do not adjust it. We take care not to slide the drape out of place when opening the folds. If a drape is incorrectly placed, we discard it. The circulating nurse peels it from the table without contaminating other drapes or the operative site
10. We protect the gloved hands by cuffing the end of the sheet over them - do not let your gloved hand touch the skin of the patient
11. In unfolding a drape from the operative site towards the foot or the head of the table, we protect the gloved hand by enclosing it in the turned-back cuff of the drape provided for this purpose. We keep the hands at the table level
12. If a drape becomes contaminated, we do not handle it further. We discard it without contaminating gloves or other items
13. If the end of a drape fall is below waist level we do not handle it further. Drop it and use another one
14. Drapes should never touch the floor
15. If in doubt as to its sterility, we consider a drape contaminated
16. A towel clip that has been fastened through a drape has its points contaminated. Remove it only if absolutely necessary, and then discard it from the sterile set-up without touching the points. We cover the area from which it was removed with another piece of sterile draping material
17. If a hole is found in a drape after it is laid down, it is covered with another piece of draping material or the entire drape discarded.
18. A hair found on a drape is removed and the area covered immediately

**NOTE:**

We ask the anaesthesiologist permission first before you start to drape the patient. The anaesthetic screen is always positioned after administration of a general as well as a local anaesthesia before draping, to elevate the drapes from the patients face.



The patient is also placed in the correct position for the operative procedure to be performed, before sterile drapes are laid down.

#### 4.6.1 Type of Drapes in standard OT pack

- 3 big sheets
- 2 medium sheets
- 1 abdominal whole sheet
- 2 leggings
- 1 mayo cover

### 4.7 Suture Materials

#### Definition

A suture is an all-inclusive term for any strand of materials used for tying up ends or approximating tissue and holding them until healing has taken place. Suturing usually takes place with a needle and strand which could be nylon, silk or other.

It is best if the needles used in suturing are solid so as to avoid the use of hollow needles and increasing the risk of HIV should a needle stick injury happen.

### 4.8 Classification of Suture Materials

Suture materials are divided into **two** categories namely:

- Absorbable sutures
- Non-absorbable sutures

#### 4.8.1 Absorbable Sutures

##### a) Surgical gut Suture:

Surgical gut suture is composed of purified connective tissue (mostly collagen) derived from either the serosal layer of beef (bovine) or the sub mucosal fibrous layer of sheep (ovine) intestines. Surgical gut suture are available in plain or chromic. Chromic gut is processed to provide greater resistance to absorption.

Surgical gut suture is indicated for use in general soft tissue approximation and/or ligation, including use in ophthalmic procedures, but not for use in cardiovascular and neurological tissues. Surgical gut is digested by body enzymes and absorbed by tissue; thus no permanent foreign body remains.



**Plain surgical gut:**

Plain surgical gut is used to ligate small vessels and to suture sub-cutaneous fat. It is not used to suture any layers of tissue likely to be subjected to tension during healing. Surgical gut is digested relatively quickly, usually in 5 to 10 days.



**Chromic surgical gut:**

Chromic surgical gut is used for ligation of larger vessels and for suture of tissues in which non-absorbable materials are not usually recommended, as in the urinary and billiard tracts as well as in anastomosing of bowel. If the absorption rate is normal, chromic surgical gut will support the wound for about 14 days and absorb completely within 120 days.

**b) Vicryl**

This is a synthetic absorbable suture material. These synthetic sutures are absorbed by a slow hydrolysis process in the presence of tissue fluids. It maintains tensile strength longer than surgical gut and then absorbs rapidly within  $\pm$  90 days.

## 4.8.2 Non-Absorbable Sutures

These are strands of material that effectively resist enzymatic digestion or absorption in living tissue. During the healing process the suture mass becomes encapsulated and may remain for years in tissues without producing any ill effects.

**a) Surgical silk**

Surgical silk is an animal product made from the fibre spun by the silkworm larvae in making their cocoons. Silk is not a true non-absorbable material. It loses much of its tensile strength after about one year and usually disappears after two or more years. It gives good support to wounds during early ambulation and generally promotes healing a little more rapidly than surgical gut, but is not as inert as most of the other non-absorbable materials.

It is frequently used in serosa of the gastrointestinal tract and to close fascia in the absence of infection. Silk sutures are dry. They lose tensile strength if wet. Therefore, do not moisten before use.

**b) Virgin silk**

Virgin silk suture consist of several natural silk filaments drawn together and twisted to form 8 – 0 and 9 – 0 strands for tissue approximation of delicate structures, primarily in ophthalmic surgery.

c) **Dermal silk**

Dermal suture is a strand of twisted silk fibres encased in a non-absorbing coating of tanned gelatine or other protein substance. This coating prevents the in-growth of tissue cells and facilitates removal after use as a skin suture.

It is used for suturing the skin particularly in areas of tension because of its unusual strength.

d) **Linen**

Surgical linen is spun from long-staple flax fibres, then twisted into tight strands and treated for smooth passage through tissue. Tensile strength is inferior to all other non-absorbable materials. Linen suture is used almost exclusively in gastrointestinal surgery.

e) **Ethanol/ Nylon**

Nylon is a smooth single strand of non-capillary material. The smaller the diameter becomes, the stronger the strand becomes proportionately. Nylon is used frequently in ophthalmic surgery because it has a desirable degree of elasticity. It is also used for microsurgery. Larger sizes are used for skin closure. It produces minimal tissue reaction.

f) **Polypropylene**

Polypropylene is an acceptable substitute for stainless steel in situations where strength and non-reactivity are required and the suture must be left in place for prolonged healing. It can be used in the presence of infection. It has become the material of choice for many plastic surgery and cardiovascular procedures because of its smooth passage through tissue as well as its strength and inertness.

g) **Skin clips**

Clips made of non-corroding metal may be used to approximate skin edges. They tend to leave more scars than other methods of skin closure, but they may be applied quickly when time is a critical factor and cosmetic result is unimportant. They can be used in the presence of infection or drainage. A specially designed instrument is necessary to apply clips.

h) **Marlex mesh**

Available as non-sterile in sheets of 15 by 30 cm. Use wire scissors, not dissecting scissors, to cut it. Steel is opaque to x-ray, which may be a disadvantage for the patient in later life.

**Advantages of synthetic mesh:**

- It is easily cut to the desired size for the tissue defect
- It is easily sutured underneath the edges of tissue to create a smooth surface
- Fibrous tissue easily grows through the openings to incorporate the mesh into the tissue to maximize tensile strength

- Polyester fibre and stainless steel mesh can be steam-sterilized immediately prior to use

i) **Umbilical tape**

Aside from its use in tying the umbilical cord on the new-born, this tape has other uses in surgery. In certain cardiovascular operations, it is used as a heavy tie, or as attraction suture. It may be put around a great vessel to retract it.

## 4.9 Common Suture Techniques

The primary suture line refers to those sutures that hold wound edges in approximation during healing by first intention. This line may have one continuous strand of suture material or a series of suture strands. A variety of techniques are used to place suture in tissues. The following are the most commonly used techniques.

- **Interrupted suture:**

Each stitch is taken and tied separately.

- **Continuous sutures:**

A series of stitches are taken with one strand of material and tied only at the ends of the suture line.

- **Retention sutures:**

Interrupted non absorbable sutures are placed through tissue on each side of the primary suture line and a short distance from it to relieve tension on it.

- **Purse-string suture:**

A continuous suture is placed around a lumen and tightened, drawstring fashion, to close the lumen. This is used when inverting the stump of the appendix, for example.

- **Traction suture:**

A traction suture may be used to retract a structure to the side of the operative field, out of the way, e.g. the tongue in an operation in the mouth. Usually a non-absorbable suture is placed through the part.

- **Subcutaneous suture:**

A continuous suture is placed beneath the epithelial layer of the skin in short lateral stitches. The suture comes through the upper layer of the skin at each end of the incision only.

## 4.10 Handling of Sutures during Surgery

1. In the preparation and use of sutures in surgery, every precaution is taken to keep the sutures sterile and to prevent prolonged exposure and unnecessary handling
2. The scrub nursing team member prepares only one or two sutures during the preliminary preparation
3. Kinks should never be removed by running the fingers over the strand. The tensile strength of a gut suture should not be tested before it is handed to the surgeon. Sudden pulls or jerks used to test the tensile strength of a suture may damage it so that it will break when in use
4. A suture or free ligature should not be too long or too short. A long suture is difficult to handle and increases the possibility of contamination because it may be dragged across the sterile field or fall below it. A short suture usually slips from the eye of the needle as it is being inserted and makes tying most difficult
5. Surgical gut sutures are sealed in packets that contain fluid to keep the material pliable. This fluid is mainly alcohol and water, but may be irritating to ophthalmic tissues. Hold packet over a basin and open carefully to avoid spilling fluid on the sterile field or splashing it into your own eyes. Rinsing is necessary only for surgical gut to be implanted into the eye
6. Surgical gut should be used immediately after removal from their packets. When the material is removed and not used at once, the alcohol evaporates and the strand loses pliability
7. Do not soak surgical gut. Excessive exposure to water will reduce the tensile strength. Before unwinding the strand, it can be dipped momentarily in water or saline at room temperature, not hot as heat will coagulate the protein
8. Silk sutures are dry. They lose tensile strength if wet. Therefore, do not moisten before use.

## 4.11 Packing and Storage Methods of Suture Materials

- Almost all suture materials are now supplied directly by manufactures in some form of sterile package ready for immediate use
- The current dry packaging method seals the suture material in a primary inner packet, which may or may not contain fluid, inside a dry outer overwrap strip packet. This unit is sterilized. This method permits self-dispensing onto the sterile field
- Packages may be stored in any moisture-proof and dustproof container
- Each primary suture packet is self-contained, and its sterility for each patient is assured as long as the integrity of the packet is maintained
- Absorbable surgical sutures are supplied by the manufacturer in sterile single – or multiple-strand packets, with or without a needle attached to the strand

## 4.12 Economical Use of Supplies and Equipment

As the cost of supplies increases, OT personnel are conscious of ways to eliminate wasteful practices, for example, throw away disposable items only. They avoid throwing away re-usable ones. Continuous emphasis on cost reduction can reduce waste and result in economics of benefits to the hospital and ultimately to the patients.

### **Principles to Remember:**

- a) We keep the varieties and numbers of instruments and supplies needed for each operation to a minimum. If the procedure book and surgeon preference cards are kept up-to-date, articles no longer used are eliminated
- b) We pour just enough solution for a skin preparation as recommended; it takes only a small amount
- c) We follow procedures for draping to provide an adequate sterile field without wasting disposable draping material
- d) We do not open another packet of sutures for that last stitch. Usually a few leftover pieces are long enough to complete the closure
- e) Syringes, hypodermic needles, drains, catheters, extra linen etc., are kept sterile. These supplies are opened only as needed, not routinely "just in case" they might be needed
- f) We do not soak too much plaster when helping with cast applications.
- g) We turn off lights when they are not needed

## 4.13 Swabs, Needle and Instrument Counts

The purpose of the count is to ensure adequate patient protection because swabs, needles and instruments are foreign objects that can cause unnecessary harm if left inside the patient.

The type and number of swabs, needles and instruments needed for different operations will vary. Each item must be considered a foreign object that can cause unnecessary harm should it be left inside the patient. Therefore, to ensure adequate patient protection, these items are counted before, during and on completion of a surgical procedure. A counting procedure is a method of accounting for items put on the sterile table for use during an operation.

Swabs, needles and instrument counts are taken on every procedure performed in the OT, especially when a major body cavity is entered or the depth and location of the wound is of such that an instrument could accidentally be left in the patient. These would include operations within the chest, abdominal and pelvic cavities, extra-peritoneal spaces, vagina, hip, shoulder or knee joint, and along the spine, mouth and throat.

#### **4.14 The Counting Procedure**

Swabs, needles and instruments are counted at different intervals i.e. before, during and after the surgical procedure.

1. As the scrub nurse counts each item, s/he and the circulating nurse count each one audibly until all items are counted
2. The circulating nurse immediately records the count for each type of swab or needles on the swab board
3. Each type and size of swab is kept separate from the other types. We count additional packages away from the counted items already on the sterile trolley, in case it is necessary to repeat the count
4. Counting is not interrupted. If uncertain about the count because of interruption, fumbling, or for any other reason, repeat it

##### **4.14.1 Swabs**

1. The scrub nurse removes the string that keeps the big swabs secured in a pack (a set of 5) and opens swabs one by one while counting it. Immediately after counting each pack each type of swab is placed in separate sterile bowls or dishes.

#### **NOTE:**

If a pack contains an incorrect number of swabs, the scrub nurse hands the pack to the circulating nurse to take it out of the OT immediately.

A faulty amount of swabs is immediately reported to the professional nurse in-charge of the OT.

**The following protocols are practiced during Swabs Counts:**

**a) Before commencement of a surgical procedure**

- Swabs are always counted by two persons of whom one must be a registered nurse. These two persons are responsible for checking and counting of swabs continuously throughout the surgical procedure
- The procedure for counting of swabs takes place in an OT
- The circulating nurse has sound knowledge of the procedure as well as the medico-legal aspects concerned
- The circulating nurse is able to identify the various types of swabs
- Each pack/ bundle of swabs is recorded on the swab-board before the next bundle is opened
- All swabs on the sterile field must be counted
- A pack with an incorrect number of swabs is handed to the circulating nurse and immediately removed from the OT. The nurse in-charge is notified accordingly
- We always use plastic sheet/ kidney tray for used swabs.
- We check beforehand that there are no swabs lying around in the OT or on sheet

**b) During surgical procedure**

- The scrub nurse assisting during the surgical procedure discards the used swabs on to the sheet spread over the floor without contaminating the sterile gloves
- The circulating nurse/OT assistant takes the swabs from the sheet with a forceps and places it in an order (in sets of 5) and counts them.

**NOTE:**

The circulating nurse never handles used swabs with her hands. A pair of disposable gloves is used for protection.

- When five (5) swabs of a kind are collected together the circulating nurse draws the attention of the anaesthesiologist to check the blood loss to determine whether the patient needs an intravenous blood transfusion or not



- The swabs are counted audibly one by one by the scrub and circulating nurse. The circulating nurse/ OT assistant touches the swabs one by one with the forceps while counting.
- The swabs are counted for a third time and at the same time one by one removed from the sheet and placed in the kidney dish. The counted swabs are now kept aside. These swabs are now out of circulation.
- If more swabs are needed during the operative procedure, the same steps are followed as described above. We do not open unnecessary packages of swabs
- Under no circumstance any swab is removed from the OT before completion of the surgical procedure

**c) On completion of surgical procedure, just before closure of the incision**

- All swabs in circulation are counted before the surgeon starts to close e.g. the peritoneum
- The surgeon is informed audibly that the swab count is correct. The surgeon acknowledges the count
- The final count is done just before closure of the skin
- The needle and instrument counts are done at the same time and the surgeon is informed accordingly
- On completion of closure of the skin all remaining swabs are removed with the approval of the scrub nurse

**NOTE:**

Omitted counts due to extreme patient emergency are documented on the operative record and a patient incident report completed by the scrub nurse. On completion of the operation, the scrub nurse signs the operative records.

**4.15 Incorrect Count**

1. The surgeon is informed of the incorrect count and does not continue with closure of the wound.
2. The entire count is repeated immediately.
3. The circulating nurse looks in the trash receptacles, furniture, on the floor, in the linen container, and throughout the room.
4. The scrub nurse looks over the drapes and under articles on the table.
5. The surgeon re-checks the field and the wound.

6. The circulating nurse then calls the supervisor of the OT to check the count.

Due to the condition of the patient or a reasonable assurance, based on wound exploration, that the item is not in the patient, the surgeon may wish to complete the closure first. However, it should be compulsory to take an x-ray before the patient leaves the OT whenever a needle or instrument count is incorrect. If the count is wrong and the lost swab cannot be found, the scrub nurse complete an incident form. This record has legal significance to verify that an appropriate attempt was made to find the missing item.

### **Classification of the various swabs in use:**

1. Abdominal swabs (large)
  - A pack contains x 5 swabs
2. Large dissecting swabs made of gauze
3. Small dissecting swabs
4. Tonsil swabs
5. Surgical patties to be used in neuro-surgery and certain orthopaedic operations e.g. laminectomy, and must be counted, they have a threaded end for ease of counting and avoiding it from getting lost.
6. Special swabs/ear buds for usage in eye surgery

### **Legal Aspects**

The scrub nurse is legally responsible for the counting of swabs, needles and instruments during the performance of a surgical procedure. In case of a swab, needle or instrument that may be left inside a patient, she/he can legally be held liable for the action. A formal swab, needle and instrument count is performed by two people of whom one is a registered nurse.

# CHAPTER 5: SURGICAL PRACTICE

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## 5.1 Ways to Stop Surgical Bleeding

There are different ways to stop bleeding:

a) **Artery clamp**

A surgeon has a big variety of methods at his disposal to stop the bleeding, of which the artery clamp is the most common. They change in size, for example Rochester Pean or the Criles artery clamp. The point can be straight or bent, but the purpose is the same, to clamp the blood vessel.

b) **Tie off**

A strand of suture material can be used to tie off the blood vessel which is, for the time being, clamped with an artery clamp. The thickness of the suture material depends on the size of the blood vessel and the choice of the surgeon.

c) **Heat**

Warm moist swabs can be used to stop capillary bleeding during extensive surgery, for example a radical mastectomy.

d) **Oxycel/ Surgcel**

This is an absorbent, hemostatical agent. It can be placed into or on the bleeding point. It does not stick to the sides of the wound, but absorbs the blood and swells, becomes tough jelly. It causes haemostasis.

e) **Bone Wax**

It is used to stop a bleeding on the bone and is made of bees wax.

f) **Surgical diathermy**

A high frequency, electrical current, provided by an electro – surgical unit, is frequently used in the theatre to cut tissue and coagulate blood.

## 5.2 Use of Diathermy

It must always be remembered that the use of diathermy during surgical operations carries a medical – legal risk. It is important that the necessary precautions are taken and regular maintenance is kept.

### **Advantages of using diathermy**

- The use of diathermy saves time.
- Blood loss is lessened.
- Also lessens the amount of suture material used.

- Is used where it is difficult to tie off bleeding points.
- Prevents trauma through unnecessary swabbing and pressure on the bleeding points.

This method, to obtain homeostasis, is called electro surgical. It has a cutting and coagulating effect because of controlled high frequency electrical currents sent through the tissue.

Electro – cauterization is the transfer of heat from a heated instrument to the tissue.

Electro – surgery is the conducting of an electric current through the tissue, also known as surgical diathermy.

The points most often used are the knife, ballpoint and barrel. The active electrode is used by the surgeon. It has a handle and a point connected to it.

### **Functions of the diathermy electrode**

The connections commonly used are:

- The knife used to cut the tissue, during, for example a thorax operation.
- The ballpoint connection, which is used to cauterize bleeders.
- The barrel which is used in a tissue biopsy.

### **Mode of operation of the diathermy**

The high current result in an immediate high temperature soon after it is switched on.

The negative electrode: also called the patient plate or distribution plate. It receives a radiated current and distributes it evenly to the operation area. The cycle is completed when the current is conducted back to the diathermy machine with a negative cable. This electrode must be as close as possible to the operating area and completely covered through contact with the patient's skin for an even and faster current distribution.

### **Risk of use of diathermy**

**Burns:** originate when there is a break in the normal cycle, for example if the patient's arm touches the metal part of the table. The active electrode can touch a wound hook and the surgeon can, by accident, step on the pedal and activate the electrode which causes a burn. The machine can be connected incorrectly. Burns can also be caused if the surgical team's gloves are perforated.

### *Preparing the patient*

1. The patient does not wear any jewellery, for example a ring, earrings, chains or watch when s/he comes into the operating theatre, because this can cause diathermy burns, this is confirmed while taking patient in OT.
2. We determine whether the patient has a metal prosthesis and report this to the surgeon and anaesthesiologist
3. We make sure no piece of clothing comes between the patient's skin and the diathermy plate. This hinders the direct contact and may lead to burns
4. We never place the diathermy plate onto a hairy area. Shave the contact area if the patient is very hairy or has big lesions
5. We do not put the plate on to a bony area, for example the elbow or knee joint, which are pressure points
6. We keep the plate as close as possible to the operating area to lessen the electric current sent through the body
7. If electro-cardiogram electrodes are used on the patient together with diathermy, they are placed as far away as possible from the operating area
8. We make sure the plate under the patient is dry and clean, after the operating area is cleaned

#### *5.2.1 Precautionary Measures*

- Before the day's operating schedule starts, the diathermy machine and plate is tested. Technician checks whether it is functional, whether there are any loose wires or broken isolation material. The apparatus is maintained regularly by him.
- We make sure that all personnel are familiar with the use and handling of the machine
- Most of the apparatus are equipped with an alarm, to warn the users that there is a break in the negative cable, or if it is incorrectly connected
- Connections, cables and electrodes are checked for damage
- We check the alarm by switching the machine on before the negative electrode is connected
- The current control knobs are kept clean, clearly marked and easy to handle
- The plate is kept dry and clean
- The cables of the two electrodes may not be too long
- The apparatus is kept close to the surgeon and as far as possible from the anaesthesiologist
- The air conditioner efficiency is checked and the humidity is kept about 60%
- We use only moist swabs when using diathermy, unless the surgeon prefers otherwise
- We start on the lowest current and turn the relevant dial slowly higher on command of the surgeon
- We clean the point of the diathermy, (positive electrode), in between use, from the coagulated blood and tissue

- When the diathermy is not in use, but still connected, the point is kept into a container, (especially for this purpose), to prevent burning the patient or one of the surgical team, if someone accidentally steps onto the pedal
- For the safety of the patient and the personnel, the instructions for the use, handling and maintenance of the machine are followed accurately

### **5.2.2 Post Operational Check**

- After completion of surgery the diathermy machine is switched off and the active and negative electrodes slowly disconnected
- The scrub nurse immediately after surgery and after the covering of the wound, removes the plate from underneath the patient, do not pull on the card, but on the plate, and checks together with the surgeon, whether there are any burns
- The head nurse (and surgeon) must be informed if there are any burns and a detailed report has to be submitted to the Nurse Manager

The scrub nurse must write a detailed report about his/her observations concerning the use of the diathermy machine before, during and after the operation.

## **5.3 Handling Septic Cases**

We have separate OTs for septic cases, machines and instruments used in these OTs are kept separate are not moved from OT.

**All operations must however be considered contaminated and the theatre is cleaned accordingly.**

### **5.3.1 Before the Day's Operating Schedule**

- Before the day's operations commence, all the apparatus should be wiped with a moist, clean cloth and the prescribed disinfectant (Vircon)
- Apparatus, for example the operating table, lights and anaesthesia machine receives special attention, as well as the mobile apparatus and apparatus mounted on the wall
- We do not wipe the electrical apparatus with a wet cloth, if they are still connected. We switch all connected apparatus off first, and then remove the plug from the socket

### 5.3.2 During an Operation

- During the beginning of an operation, contamination around the sterile area is limited to a minimum
- Only the necessary amount of personnel is allowed in the theatre and the movement in and out of the theatre is limited to a minimum
- Used swabs are disposed off into a bucket. Soiled swabs are at no time handled with bare hands, but with forceps, gloves and a kidney dish available for this purpose
- The floor is cleaned with a wet cloth as soon as possible after the operation, to avoid blood splashes from drying
- All equipment that is not necessary for septic operation is removed from the OT

### 5.3.3 In Between Operations

- All activities at the end of an operation are executed purposefully. All cases are treated as contaminated and the theatre is cleaned accordingly
- All used linen is put into a yellow plastic bag and the bag is closed. A new plastic bag must be used for every operation
- Used syringes, needles and blades are placed into the safety box immediately for incineration. It is important that this waste material is handled correctly, to avoid injury to the theatre and hospital personnel
- All used items on the anaesthesia machine, like the intra tracheal tube, airways and masks, etc., are also placed into a plastic bag (**identify as septic**) and sent to the relevant section for cleaning and sterilization
- The blades of the laryngoscope are removed from the handle, after every anesthetic administered and are rinsed under running tap water, dried off, and kept ready for the next anaesthesia case.
- After completion of the operation all instruments, basins and bowls, which were used, are rinsed, cleaned and sterilized
- Suction bottles are washed in the sluice room and packed together with the suction tubes, then sent to the relevant section for cleaning
- Soiled apparatus, for example the anaesthesia machine, operating table swab rack, are wiped with a clean cloth soaked in the recommended antiseptic solution. The floor is wiped down with water and detergent after each operation if there is visible spillage and needs to be cleaned
- Vircon Germiclean Disinfectants are only used to wipe down the cleaned surfaces of an operating theatre at the end of a session or list. This allows time for the disinfectant to remain in contact with the surface for a long enough period to be active. Disinfectants is NOT used to wash down floors or surfaces

### 5.3.4 After Completion of the Day's Operating Schedule

- All theatres which were in use during the day are washed thoroughly
- Remove all used items, as mentioned before, for cleaning, re-sterilization and/or incineration
- All the equipments are cleaned with water and detergent and dried. It is then wiped over with 70% alcohol and allowed to dry. The use of hypochlorite (Biocide) is not recommended because it corrodes metal and destroys most of the equipment
- Air conditioners are left on for a further 30 minutes or an hour
- **There is no indication to use ultraviolet light in the OT and is not recommended**
- All mobile and detached apparatus in the theatre are washed with water and detergent and moved outside. There is no need to use hypochlorite. However, if a disinfectant is indicated, 70% alcohol is sufficient
- All apparatus mounted on the wall are washed only where contamination has taken place
- We remove all refuse and make sure that all trolley wheels are working well. Domestic oil can be used if they are dry. Push the trolley over a cloth dipped in the biocide solution to clean their wheels as well
- All apparatus are moved back into the OT to be ready for any emergency and/or the following day's operating schedule. We make sure everything is in working condition
- The other areas, like the scrubbing room, patient waiting room, reception area, recovery room, all store rooms and offices are dusted daily and the floors are washed
- After the cleaning process the mops and buckets are washed, dried and ready for use
- The dust cloths are washed and hung up to dry. The water used for cleaning is thrown out and the bucket is dried
- Special attention is given to the sluice rooms. They are cleaned thoroughly
- Instruments are washed, packed and labelled before being sent to CSSD
- Personnel leave theatre through the dirty corridor except the anaesthesiologist and anaesthesiologist nurse

## 5.4 The Recovery Room

The recovery room is situated near the OT. It is then easily accessible to a doctor should a patient develop an emergency situation.



The Anaesthesia resident **ALWAYS** accompanies patient to the recovery room. Upon arrival, he/she first connects the patient to oxygen saturation and BP monitor apparatus. Once patient is stable, handing-over report is given to recovery room staff.

The Anaesthesia resident on duty in the recovery room is responsible for the post – operative care of the patient until the patient is ready to be transferred to another ward. One registered nurse is on duty in the recovery room and she helps the resident.

### **5.4.1 Receiving the Patient in the Recovery Room**

Thorough identification of the patient via case paper sheet is important. The Anaesthesia resident gives the nurse and anaesthesia resident in the recovery room a complete report on the patient. The condition of the patient, type and length of anaesthesia, type of operation and results, drainage tubes, intravenous transfusions, complications, post-operative medication prescribed and other special orders are reported.

#### **5.4.1.1 Observations and Care**

The recovery room nurse already makes important observations while receiving the patient from the theatre resident, for example the colour of the skin, respiration, level of consciousness, excessive bleeding from the wound site and the position on the trolley.

## 5.5 Discharge of the Patient from the Recovery Room

### **We check following things**

- Before the patient is transferred to a ward s/he must be completely awake and orientated
- Muscle relaxing medication must have worn off completely
- The respiration must be satisfactory
- The pulse rate must be normal
- All reflexes must have returned
- The patient is handed over to the ward nurse with all the relevant information
  - A complete report is given to the ward nurse, with the relevant information on the type of operation performed
  - Post-operative orders and prescribed medication which the patient must receive are given
- A porter accompanies the patient to a ward

**We obtain the permission from the anaesthesiologist before the patient is transferred to a ward.**

## **5.6 Specimens for Pathology**

- Consult with the surgeon accordingly regarding the tissues removed from the patient during surgery that must be sent to the laboratory for examination
- As soon as a specimen is removed, scrub nurse checks first with the surgeon before the tissue is placed into any solution
- Specimen for cultures, for example a throat swab, and smears, for example pap smears, are not placed into a formalin solution, but must be taken to the laboratory as soon as possible
- Specimen that needs to be placed in a special solution of 10% formalin in saline are put immediately after removal from the patient. This solution prevents the tissue from decomposing
- Should more than one tissue specimen be taken from one patient, every specimen is placed into a separate container and be marked accordingly
- Specimens of one patient that has to go to different laboratory sections, e.g. cytology, histology, etc, should be sent in separate bags and forms to that specific department
- In case of a tumour or growth, of the breast for example, the surgeon performs a dissection biopsy to determine a diagnosis. These specimens are not placed into a fixing agent. They are placed dry into a container with the complete particulars of the patient on the label and taken to the pathologist immediately. The surgeon waits for the results of the dissection. The pathologist informs the surgeon as soon as the result is known. If the result is not malignant, the tissue is removed locally, but if it is malignant, the tissue will have to be removed extensively (frozen section performed).
- The specimen is clearly marked with the following information on the label:
  - The name and surname of the patient
  - The registration number
  - The ward in which the patient is placed
  - The type of specimen
  - The name of the operation
  - The date and time when the specimen was taken
- We ensure that every specimen carries the correct information to prevent a mix-up of specimen which may lead to a faulty diagnosis and treatment

- Strict control is therefore practiced over every specimen. The scrubbing nurse is held responsible for a missing specimen

The implications of a missing specimen:

- It prolongs the patient's stay in hospital, which has financial implications
- The doctor cannot make the correct diagnosis and the patient cannot receive the necessary treatment and medication. This causes the patient unnecessary discomfort
- The patient may undergo surgery again for another tissue specimen
- For efficient control over specimens, we have kept a book/ register in which all specimens are recorded, with the same information as on the label. A space is made available for the signature of the person who recorded the specimen into the book/ register, as well as the signature of the person who received the specimen at the laboratory
- A special container or basket for the reception of specimens at a central point is kept. At the end of the day's operating schedule the nurse checks all specimens with the entries in the book/ register
- A reliable person, for example the porter, then takes the specimens and the book/ register to the laboratory and the person who receives them at the laboratory signs the specimen book in the space provided for this purpose
- The container for the specimen is big enough to carry the specimens and that it is covered completely with a formalin solution. We make sure the lid fits well and tight
- In the space provided on the operating slip it is recorded that the specimen was sent to the laboratory. This information is also recorded in the operation register

## 5.7 Emergency Equipment/ Emergency Situations

Patients can, at any time, before, during surgery or during the post-operative period, develop an emergency situation, for example cardiac arrest, obstruction of the air way, respiratory arrest, etc. It is therefore important that all the emergency equipment/ apparatus be at hand, ready and in working condition.

Emergency equipment is checked regularly to determine whether they are in perfect condition. The patient may lose his life due to negligence if the personnel do not care for the emergency equipment and apparatus.

An emergency trolley with different emergency items, like resuscitation medication, syringes, needles, intravenous infusions with different intravenous sets, must be available. A monitor with a defibrillator must be available in the recovery room at all times for emergencies. Make sure the electrodes and E.C.G. jelly is with the machine at all times. Defibrillator, anaesthesia machine/ventilator and monitors must be in the recovery room.

We make sure sufficient oxygen supply, masks, airways and intra-tracheal tubes as well as a laryngoscope are available. We check that the suction apparatus is connected and in working condition.

## 5.8 Cardiac Arrest

Intra-operatively, the anaesthesiologist normally takes charge if a cardiac arrest occurs. The nurse in-charge is notified. The circulating- or anaesthetic nurse is available immediately and assists the anaesthesiologist during the resuscitation of the patient. The orders given by the anaesthesiologist is carried out carefully and precisely. The nurse records the time when the cardiac arrest has been diagnosed.

### **Procedures that may be carried out in case of cardiac arrest:**

- a. The defibrillator is kept ready in case of cardiac arrest for the administering of cardiac treatment. The two electrodes are lubricated with a cardiac jelly and then placed on the patient's thorax, one over the apex of the heart and the other over the upper third of the sternum. The defibrillator is used by the anaesthesiologist or other doctors in the OT.
- b. The surgeon may decide to perform an open cardiac massage. After opening the thorax s/he takes the heart in his hands and pumps it regularly at 80 – 100 times per minute.

The anaesthesiologist ensures an open airway and administers 100% oxygen to the patient. The surgeon stops surgery until the patient's condition stabilises. The surgeon and scrubbing nurse remains sterile. The surgeon continues surgery if the patient's condition improves.

The surgeon will decide whether or not to continue surgery if the patient's condition does not improve. The scrubbing nurse covers the wound and assists with the resuscitation if surgeon decides not to continue. External cardiac massage will be in the meantime applied by the surgeon or assistant surgeon. The patient is kept in the theatre or recovery room until his condition allows surgery to continue, or transferred back to the ward.

**ALL** health personnel involved in the patient care i.e. scrub nurse, doctor, anaesthesiologist writes an incident report about the event in accordance with the policy of the institution. The scrub nurse records the event in red ink in the operation register next to the patient's name. The observations that were done and emergency medicines given are noted in the records.

## 5.9 Tracheostomy

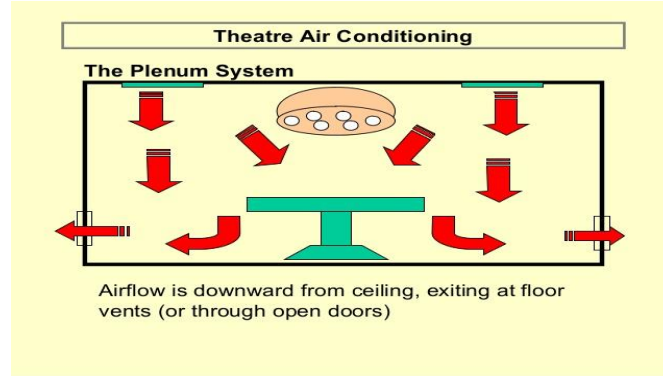
The tracheotomy instrument set must at all times be kept ready and available in the OT, for when it is needed. We make sure the set is complete, especially whether the knife with a blade and the tracheal dilator are on the set.

A complete set of tracheotomy tubes of different sizes is available. A tracheotomy can be done under local anaesthetic, however where the patient's condition cannot allow it will be done without anaesthetic in order to save the patient's life.

# SINGHGAD TECHNICAL EDUCATION SOCIETY'S



## SMT.KASHIBAI NAVALE MEDICAL COLLEGE & GEN.HOSPITAL



### OPERATION THEATRE AC MANUAL



## **Air Conditioning In OT**

**A.** The air conditioning requirements for Operation Theater at SKNMC, Pune have been deliberated at length with manufacturers, engineers, technical committee members and other stake holders.

**B.** operation theaters have been divided into groups:

**1. *Super specialty OT: New OT complex has 2 OT's*** Super specialty OT meant for Neurosurgery and Orthopedics (Joint Replacement).

**2. *General OT:*** This includes operation theatres for Ophthalmology, Orthopedic surgery, Obstetrics & Gynecology and all other basic surgical disciplines.

***Daycare centre:*** Daycare surgery for selected patients to hospital for a planned surgical procedure, returning home on the same day, would fall under the category of general OT.

**C.** The following basic assumptions have been kept in view:

- Occupancy: Standard occupancy of 5-8 persons at any given point of time inside the OT is considered.
- Equipment Load: Standard equipment load of 5-7 kW considered per OT. For super- speciality OT, standard equipment load considered is 7-9 Kw.
- Ambient temperature & humidity at each location is considered while designing the system.

## **Design considerations for all Operation Theatres -**

- The AHU of each OT is dedicated one and is not linked to air conditioning of any other area for all OT constructed.
- Window & split A/c are not used in any type of OT.
  
- *Paint- antibacterial, anti-fungal*
- *OT door – automatic/ Hermitically Sealed/Touch free.*
- *General Lights – Clean room lights*
- *Provision of safety against static charge.*
- *Separate power circuit for equipment like C-arm*
- *Flooring – seamless, incl skirting,*



## REQUIREMENTS – Super Specialty OT

### 1. Air Changes Per Hour:

- Minimum total air changes followed are 25 based on international guidelines
- The fresh air component of the air change is 5 air changes (ie 20%) out of total minimum 25 air changes.
- The supply and return air ducts are of non-corrosive material.
- There is no internal insulation and acoustic lining on ducts

**2. Air Velocity:** The vertical down flow of air coming out of the laminar flow boxes is able to carry bacteria carrying particle load away from the operating table. The airflow is unidirectional and downwards on the OT table. The air velocity is recommended as per the guidelines and is 25-35 FPM from non-aspirating unidirectional laminar flow ceiling array's.

**3. Positive Pressure:** is maintained at all times in the OT (operational and non operational hours). Minimum positive pressure is 2.5 pascals.

**4. Outdoor air intakes:** The location of outdoor air intake is away from contaminated sources.

**5. Air handling in the OT including air Quality:** Air is supplied through Terminal HEPA filters in the ceiling. The minimum size of the filtration area is 1 feet on each side of the OT table to cover the entire OT table and surgical team. The minimum supply air volume to the OT (in CFM) is compliant with the desired minimum air change.

**6. Air Filtration:** The AHU has an air purification unit and air filtration unit. There are two sets of washable flange type pre filters of efficiency 90 % down to 10 microns and 99% down to 5 microns with aluminum frame within the AHU. The necessary service panels are provided for servicing the filters, motors & blowers. HEPA filters of efficiency 99.97% down to 0.3 microns are provided in the OT and not in the AHU.

**7. Temp & RH** for Super-specialty OT: it is maintained  $21\text{ C} \pm 3\text{ C}$  (except for Ortho for Joints replacement as  $18\text{ C} +0 \& -2\text{ C}$ ) with corresponding relative humidity of 60%. Appropriate devices to monitor and display these conditions inside the OT are installed.

## **REQUIREMENTS – General OT**

### **1. Air Change Per Hour:**

- Minimum total air changes are 25 based on international guidelines.
- The fresh air component of the air change are 5 air changes (ie 20 %) out of total minimum 25 air changes.

**2. Air Velocity:** is 25-35 feet/min.

**3. Positive Pressure:** is maintained at 2.5 pascals to prevent outside air entry into OT.

**4. Air handling/Filtration:** It is same as previous.

**5. Temperature and Humidity:** The temperature is maintained at 21C +/- 3 Deg C inside the OT all the time with corresponding relative humidity between 40 to 60%. Appropriate devices to monitor and display these conditions inside the OT are installed.

**Maintenance of the system:**

During the nonfunctional hours, AHU blower is operational round the clock without temperature control. Air changes are reduced to 25% during non-operating hours though positive pressure is maintained

Preventive maintenance of the system:is carried out in terms of cleaning of pre filters, micro vee at the interval of 15 days. Preventive maintenance of all the parts is carried out as per manufacturer recommendations.

**Validation of system to be done as per ISO 14664 standards and include:**

- ✓ Temperature and Humidity check .
- ✓ Air particulate count .
- ✓ Air Change Rate Calculation .
- ✓ Air velocity at outlet of terminal filtration unit /filters .
- ✓ Pressure Differential levels of the OT with respect to ambient / adjoining areas .
- ✓ Validation of HEPA Filters by appropriate tests like DOP etc; repeat after 6month in case HEPA found healthy .

