

Sterilization and Operating Room Set Up



Surgery Team
MED 433

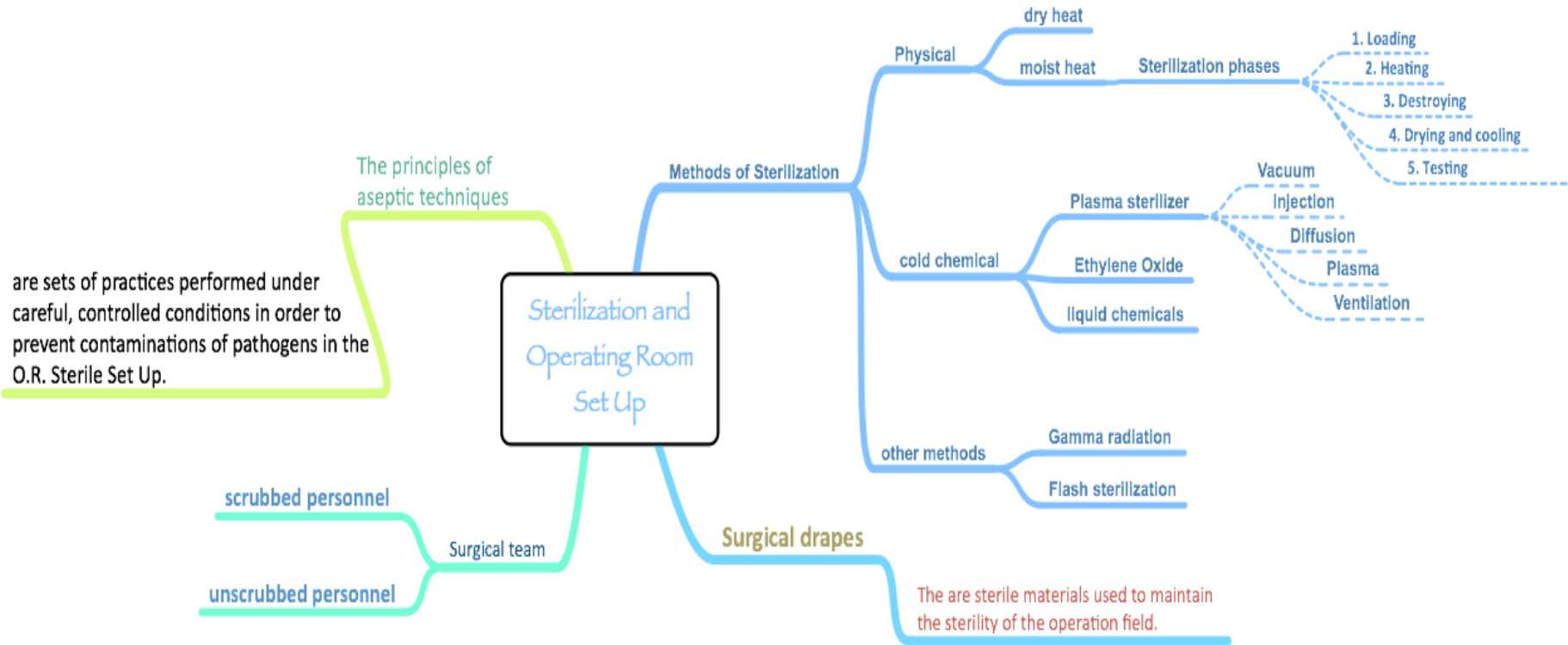


Objectives :

- I. Different methods of sterilization & the sterilization processes.
- II. The principles of aseptic techniques & how to apply them in the clinical areas & O.R.
- III. The Operating Room set up to ensure safe environment & safe surgical practices towards patient safety.

Sources : Slides, Raslan's Notebook

Color Index : Slides & Raslan's | [Doctor's Notes](#) | Extra Explanation | **Important**



A lot of details in the lecture, just try to go through it



Want to Know how to Scrub-in ? [Here you go future surgeon](#)



Asepsis	Freedom from infection or the absence of microorganisms that cause diseases.
Sepsis	generalized reaction to pathogenic microorganism which is evident clinically by signs of inflammation & febrile conditions of inflammation.
Sterile	Absence of all microorganisms including bacteria, viruses and spores.
Aseptic Techniques	Practices that restrict microorganisms in the environment, equipment, supplies & prevention of the normal body flora from contaminating the surgical wound. Methods by which contamination with microorganisms are prevented.
Contamination	introduction of microorganisms to a sterile field.
Sterilization	process by which all living microorganisms both pathogenic & non-pathogenic including spores are killed.
Disinfection	process by which renders inanimate objects free of pathogenic bacteria.
Antiseptics	agents that renders microorganisms on living tissue inactive by preventing their growth. Used to disinfect body surfaces, skin & tissue. Inhibits the growth of endogenous bacteria. (Combat sepsis)
Disinfectants	agents that kill all growing or vegetative forms of microorganisms thus completely eliminating them from inanimate objects.

Prevention of infection in health care areas is largely dependent on:



- ✓ There **is no degree of sterility**. An item is either sterile or non-sterile. It can never be relatively sterile.
- ✓ Surgical instruments, devices & heat sensitive items are sterilized by the method recommended by the manufacturer.
- ✓ **No disposable sterile items designed for single use should be reprocessed.**
- ✓ Sterilizing agent should be in contact with every part of the item to be sterilized at specific period of time & temperature.



Methods Of Sterilization

Physical Methods	Cool Chemical Methods	Other Methods
1. Dry Heat-Hot air ovens, infrared ovens. 2. Moist heat- Steam Autoclave- (Available in KCUH)	1. Plasma Sterilizer (Sterrad)- (Available in KCUH) 2. Ethylene Oxide (E.O.) Sterilizer 3. Liquid Chemicals	1. Gamma Radiation 2. Flash Sterilization

1. Physical Methods

Moist heat, at raised atmospheric pressure

- Steam sterilization

Characteristics	Mechanism	Use
<ul style="list-style-type: none"> ✓ Most inexpensive. ✓ Effective method of sterilization. 	Steam under pressure permits permeation of moist heat to porous substances by condensation & results in destruction of all microbial life.	sterilizing surgical instruments, dressings, drapes, swabs, laps sponges, culture media, etc.

Example; Steam autoclave (steam under pressure)

❖ Steam Autoclave

An autoclave is a closed chamber in which items are subjected to steam at high pressure & temperature above 100 °C.

❖ Types of Autoclaves:

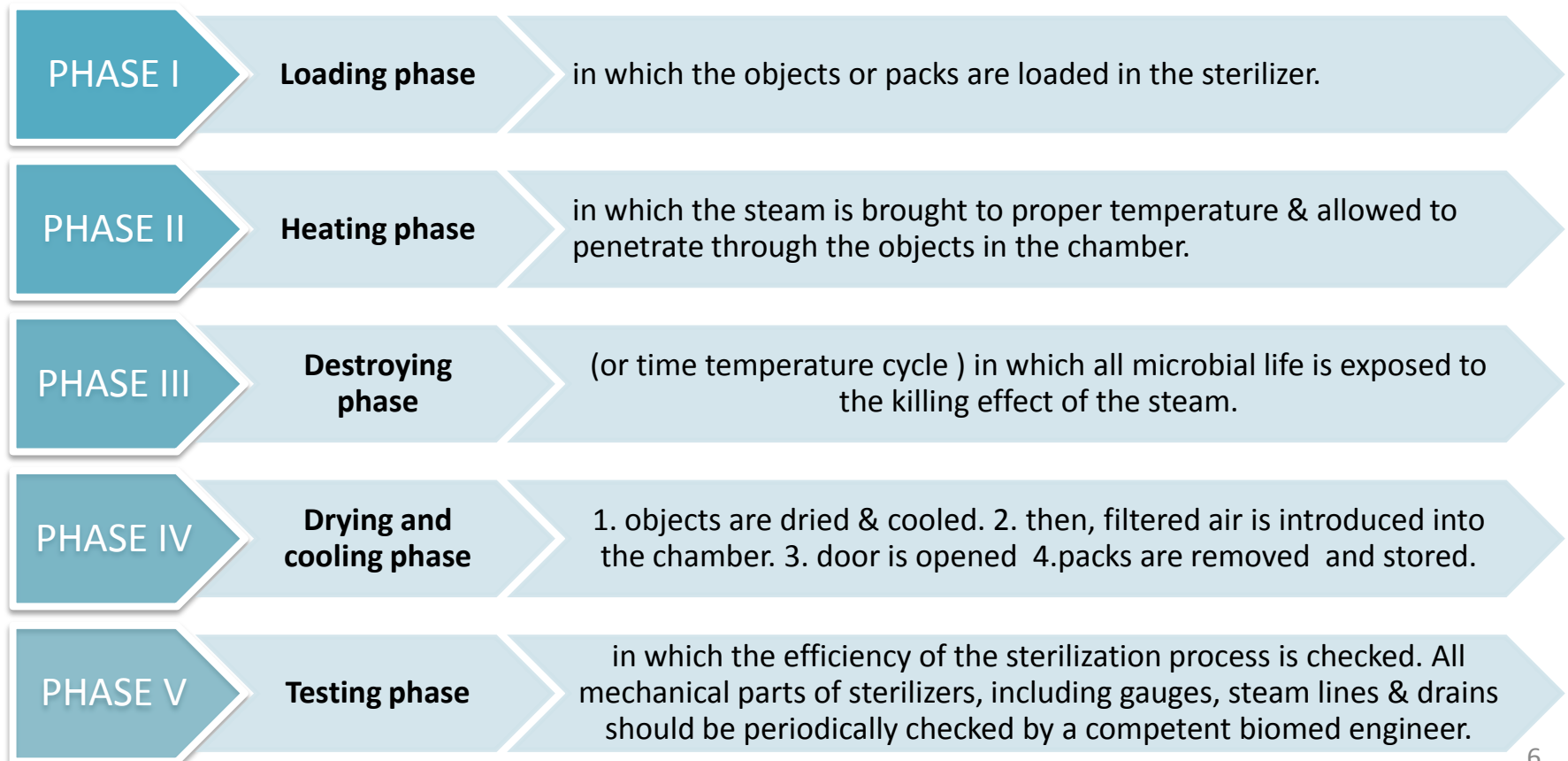
Downward Displacement Autoclave	High Vacuum / High Pressure Autoclave
Air is removed in two stages & sterilization is by pure steam.	<ul style="list-style-type: none"> ✓ Air is removed by powerful pump automatically. ✓ Steam penetrates the load & very rapid sterilization of surgical items & packs is possible in 30 to 45 minutes at 134°C & up. (Available in KCUH)

❖ Preparation of items before sterilization:



- ✓ Ultrasonic Washer: for delicate instruments like in vascular or neurosurgery.
- ✓ Automated Washer / Dryer: washer and dryer.

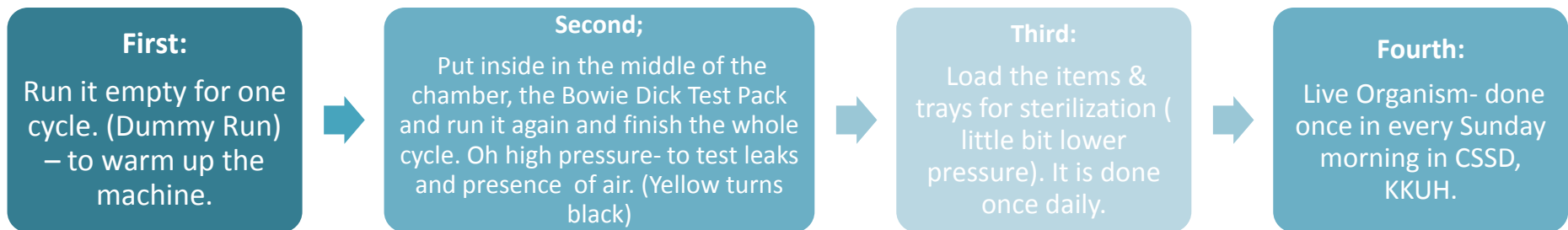
❖ Steam Sterilization Process (Five Distinct Phases)



❖ Methods of Testing the Effectiveness of Autoclaves:

1. **Mechanical:** chart & gauges usually carried out by Biomed Engineer.
2. **Chemical:**
 - ✓ by the use of autoclave tapes, strips and card. A daily test in an empty chamber using a heat sensitive tape. This is for high vacuum/high pressure autoclaves. Ex. **Bowie Dick Test Pack:** a pack with a chemical indicator both outside & inside to verify that steam has penetrated the pack & to test air leaks.
3. **Biological:**
 - ✓ **Biological Indicator- Biological Spore Testing;** To test autoclaves regularly with **Geobacillus stearothermophilus**, which is one of the most heat tolerant species of bacteria. If sterilization in an autoclave does not destroy the Geobacillus spores, the autoclave is not working properly.

❖ Testing the Effectiveness of Steam Autoclave:



❖ Making of sterile packs

- Should have the following external indications showing that they have been processed:



- ✓ **Autoclave tapes** show a pack that has been through sterilization cycle & should be visible outside every pack sterilized.
- ✓ Autoclave tape is designed black when specified temperature is reached
- ✓ Must be labeled as to its content with the (processing date , autoclave used, and load number). This assists locating processed items in case of recall

❖ Storage of sterile packs:

- ✓ Sterile packs / sets should be left untouched & allowed to cool down before storage to avoid condensation inside
- ✓ must be handled as little as possible to reduce the risk of contamination
- ✓ Sterile packs should be stored **open shelves**:
 - The lowest shelf should be 8-10 inches of the floor
 - The highest shelf should be 18 inches from the ceiling
 - All shelves Should be at least 2 inches from the walls
- ✓ Sterile packages must be stored and issued in correct order.
- ✓ Either good for 30 days or 6 months to one year depending on how the packages are wrapped & what type of wrapped used.
- ✓ **Shelf life** : refers to the length of time a package maybe considered sterile .
- ✓ Traceability (tracking system)
- ✓ Storage room for sterile items.
- ✓ Traffic is restricted to CSSD (central sterilization supply department) personnel & trainees only.
- ✓ One flow.
- ✓ Subjected to regular adequate pest control to prevent contamination from rodents, ants & cockroaches.

❖ Causes of failure to deliver a sterile load:

- ✓ **Faults in the autoclave** (poor quality – way it is operated – failure to remove the air and condensate – faulty gauges and timings – leaking door seals)
- ✓ **Errors in loading**: (large packs – excessive layers of wrapping materials – over packing)
- ✓ **Recontamination after sterilization due to**:
 - An inadequate air filter and leakage into the chamber.
 - Wet or torn packs.
 - Incorrect storage.

2. Cold Chemical Methods

A. Plasma Sterilizer

Plasma Autoclave (Sterrad)

- ✓ Low Temperature Hydrogen Gas Sterilizers
- ✓ Gentle patented sterilization process with the use of **hydrogen peroxide & generation of low temperature gas plasma.**
- ✓ Spore testing should be performed at the same interval as testing of other sterilizers.
- ✓ 104°F-131°F (40°C-55°C). – **45 minutes to 1 hour.**
- ✓ Five phases to the (Sterrad) Plasma sterilization cycle:



■ Uses:

- ✓ To sterilize delicate instruments that are heat & moisture sensitive, such as micro instruments, cameras, scopes & light cords.

■ Advantages

- ✓ **speed, safety of use, & no aeration.**

B. Ethylene Oxide (EO)

- ✓ Colorless gas at ordinary temperature.
- ✓ Well established technique for sterilizing heat sensitive articles.
- ✓ Exposure period of 5 to 7 hours is necessary for complete E.O. sterilization.
- ✓ Requires 6-8 hours of aeration.

■ Uses:

- ✓ Used for sterilizing vascular & bone grafts, delicate instruments, plastic articles such as disposable syringes, bacteriological media & vaccines. (Used on Commercial basis)

■ Advantages:

- ✓ Easily available and effective against all types of microorganism.
- ✓ Used only if materials are heat sensitive and unable to withstand sterilization by saturated steam under pressure
- ✓ Penetrate through masses of dry materials, doesn't require high temperature, humidity or pressure.
- ✓ Non corrosive and non damaging to items.

B. Ethylene Oxide (EO)

Disadvantages:

- ✓ Lengthy process with long aeration periods.
- ✓ Expensive & more complex process.
- ✓ Produce serious burns on exposed skin.
- ✓ Toxic & may cause Cancer. (Precautions should be taken to protect personnel.)

C. Liquid chemical sterilization

- ✓ Can destroy all forms of microbial life including bacterial, fungal spores, tubercle bacilli & viruses.
- Used: for sterilization when steam, gas or dry heat is not indicated or available.
- Common liquid chemicals (agents) - capable of causing disinfection/ sterilization:

Aqueous Formaldehyde	<ul style="list-style-type: none">✓ Oldest chemo sterilizers✓ known to destroy spores.✓ rarely used due to its pungent odor.
Aqueous Glutaraldehyde (Cidex)	<ul style="list-style-type: none">✓ colorless liquid chemical with pungent odor.(no longer recommended.)✓ Short soaking (20 minutes-30 minutes) only provides disinfection of instruments.✓ Complete immersion in activated glutaraldehyde solution for 10 hours achieves sterilization.✓ Any immersion of less than 10 hours must be considered as only as disinfection (Spores not killed.)✓ Toxic & can cause nasal (respiratory mucosa), eye & skin irritation.
OPA Cidex-(0.55% ortho-phthalaldehyde)	<ul style="list-style-type: none">✓ Clear, pale-blue liquid.✓ contains 0.55%the non-glutaraldehyde solution✓ for disinfection of flexible endoscopes and other medical devices.
Alcohol	<ul style="list-style-type: none">✓ 70 % Ethyl Alcohol & 70% Isopropyl Alcohol-✓ Effective & rapidly acting disinfectants.
Hypochlorite	<ul style="list-style-type: none">✓ Broad spectrum chlorine disinfectant✓ effective against viruses, fungi, bacteria & spores.✓ Disinfectant of choice against hepatitis B virus.
Chlorexidine	<ul style="list-style-type: none">✓ Skin antiseptic & highly active against vegetative bacteria. Used in hand scrubbing Ex. Chlorhexidine Hand Rub

3. Other Methods

A. Gamma radiation

- ✓ Radioactive material, such as a **Cobalt-60 source**, emits radiation (gamma rays), pure energy that is generally characterized by its deep penetration and low dose rate.
- ✓ that effectively kills microorganisms.
- ✓ Total sterilizing time is measured in **days**.
- Used on
 - ✓ commercial basis for the sterilization of a wide variety of **pre-packaged hospital items** and devices.

B. Flash Sterilization

- ✓ Should be used in selected clinical situations & in a controlled manner.
- ✓ **Use of flash sterilizer should be kept to a minimum & only for emergency use.**
- ✓ Flash sterilization should **not be used as a substitute** for proper sterilization methods.
- ✓ Flash sterilization should not be used for implantable devices.

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Section three – Practice IV, 2

- Flash sterilization may be associated with increased risk of infection to patients because of pressure on personnel to eliminate one or more steps in the cleaning and sterilization process. It is essential that all steps in the sterilization process be performed in a conscientious manner.





❖ Definition and points of emphasis

➤ Aseptic Techniques:

are sets of practices performed under careful, controlled conditions in order to prevent contaminations of pathogens in the O.R. Sterile Set Up.

- ✓ Most strictly **applied in the O.R.** because of direct & extensive disruption of skin & underlying tissues.
- ✓ Practices that ensure safe & effective ways in establishing & maintaining sterile field in which surgery can be performed safely.
- ✓ Aseptic techniques help to prevent surgical site infection (SSI).
- ✓ All items used within the sterile field must be sterile.
- ✓ Tears in barriers & expired sterilization dates are considered breaks in sterility.
- **Sterile items presented to the sterile field must be checked for:**
 - ✓ Package Integrity
 - ✓ Expiration Date
 - ✓ Chemical Process Indicator
- ✓ Use of unsterile items contaminate the sterile field.
- ✓ Sterile field is created as well as sterile packages are opened as close as possible to time of actual use.
- ✓ Moist areas are considered not sterile.
- ✓ Scrubbed personnel should function within a sterile field.

❖ Surgical team is made up of:

1. **Sterile members or scrubbed personnel:** work directly in the surgical field.
 1. Surgeons, Scrub nurse, O.R. Technician
 2. **Non-sterile members or unscrubbed personnel.**
 - ✓ Anesthetists, Circulating nurses, Anesthesia Technicians, X-Ray Technician
- ✓ Surgical team members must wear the scrub suit attire, surgical cap, surgical face mask before performing surgical hand scrub.
 - ✓ Surgical hand scrubbing to be performed prior to donning of sterile gown & sterile gloves.
 - **Surgical hand scrubbing and donning of gowns/ sterile gloves:**
 - ✓ **First surgical hand scrub should be at least 5 minutes** & the subsequent hand scrub, at least 2 to 3 minutes.
 - ✓ Substitute for surgical hand scrub is hand rub with 2 antiseptics (Chlorhexidine & Alcohol)
 - ✓ After donning the sterile gown is donning the sterile gloves. (**Closed Gloving Technique is recommended in O.R.**) Never let the fingers extend beyond the stockinette cuff.
 - ✓ The sterility is limited to the portions of the gowns directly viewed by the scrubbed person.
 - ✓ **Note:** Cuff should be considered unsterile due to it tends to collect moisture & it is not an effective barrier. Therefore, cuff should always be covered by sterile gloves.
 - **Gowns are considered sterile only on the:**
 - ✓ Front of gown from chest to the level of the sterile field.
 - ✓ Sleeves of gown from 2 inches above the elbow to the cuff.
 - **Areas of gown considered unsterile are:**
 - ✓ Gown's neckline
 - ✓ Shoulders
 - ✓ Under the arms
 - ✓ Back
 - ✓ Not to allow the hands or any items **to fall below the level of sterile field.**
 - ✓ No sitting nor leaning against unsterile surface because **of great contamination.**





❖ Surgical drapes

- ✓ Sterile drapes are used to create a sterile field.
- ✓ **The are sterile materials used to maintain the sterility of the operation field.**
- ✓ Surgical Drapes establish an aseptic barrier minimizing the passage of microorganisms from non sterile to sterile areas.
- ✓ Sterile surgical drapes should be placed on the patient, parts of O.R. table & equipment included in the sterile field, leaving only the incision site exposed.
- **Draping process:**
 - ✓ Only the scrubbed personnel should handle sterile drapes by cuffing the draping material over the gloved hand.
 - ✓ When draping, it should be compact, **held higher than the O.R. table** & draped from the prepped incision site to the periphery.
 - ✓ **Tables are only sterile at table level.**
 - ✓ Once the drape is placed, it should not be moved or re-arranged & **only top surface is considered sterile.**
- **A sterile field should be constantly maintained and monitored.**
 - ✓ Surgical team members should maintain a vigilant watch on the sterile field & point out any contamination immediately.
 - ✓ When breach of sterility occurs, an immediate action to correct the break in technique.
 - ✓ Contaminated item must be removed immediately from the sterile field.
 - ✓ **The operative site is the center of the sterile field & all scrubbed personnel should remain close to this area.**
 - ✓ Movements can cause contamination to the sterile field.
 - ✓ Surgical team should move only from sterile areas to sterile areas.
 - ✓ Change positions –Should turn back to back or face to face & maintain a safe distance close to the sterile field.



❖ Points of emphasis:

▪ General:

- ✓ Items of doubtful sterility must be considered unsterile.
- ✓ When a sterile barrier is permeated, it must be considered contaminated.
- ✓ Once set up, the sterile field should be monitored constantly and not be left unattended.
- ✓ Non sterile items should not cross above a sterile field.
- ✓ The margin of safety is generally identified as a minimum of 12 inches.

▪ Scrubbed Personnel:

- ✓ Keep arms & hands within the sterile field at all times to avoid any accidental contact with unsterile areas.
- ✓ Keep gloved hands in sight & keep **at waist level or above because below the waist is contaminated**.
- ✓ Maintain a safe distance when approaching unsterile objects and personnel. Identify safe boundaries

▪ Unscrubbed Personnel:

- ✓ Remain in non-sterile area to prevent contamination of the sterile field.
- ✓ **Always face the sterile field on approach and should never walk between 2 sterile fields.**
- ✓ O.R. personnel with colds & URTI should avoid working inside the theater.

▪ Sterile Wound Dressing:

- ✓ Dressing material should only be opened during wound dressing time.
- ✓ **Wound or surgical site should be cleaned & dried before application of the dressing material.**
- ✓ Applied before surgical drapes are removed to avoid contamination of the incision

Thank You..

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