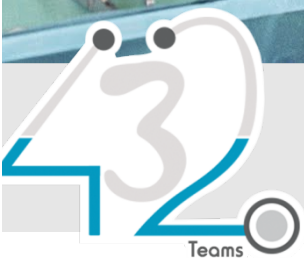




432 Surgery Team

9 Sterilization & O.R. Set Up



Done By:
Ibrahim Abunohaiah

Reviewed By:
Name

جامعة
الملك سعود
King Saud University

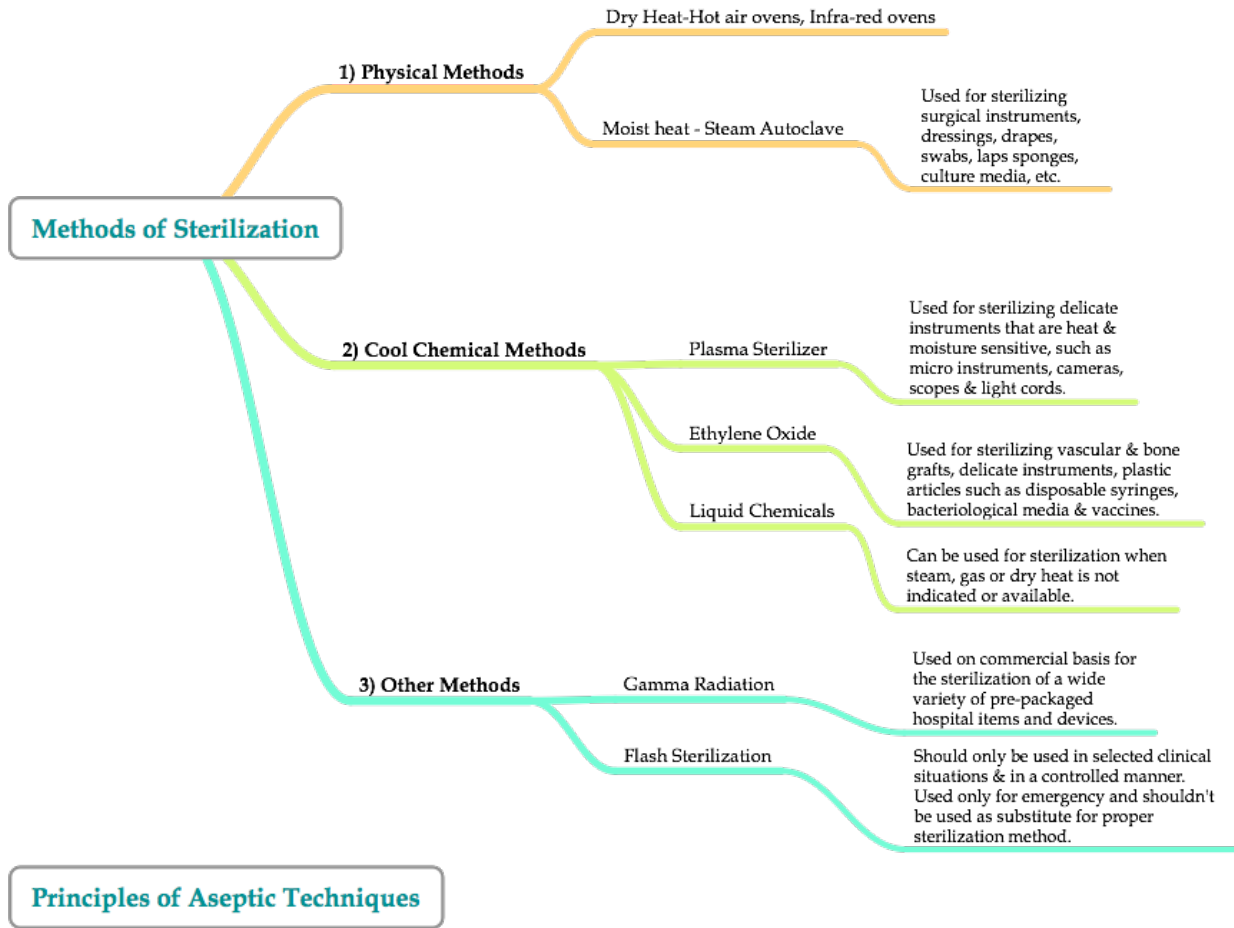


Objectives

To be able to acquire knowledge and understanding on the following:

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

Mind Map:



Terminologies:

- Asepsis

The 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 & febrile conditions. **Clinically means appearance of sings; inflammation& fever.**

- Sterile

Absence of all microorganisms including bacteria, spores and viruses.

- 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.

- 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)

- Disinfection

Process by which renders inanimate objects free of pathogenic bacteria.

- Disinfectants

Agents that kill all growing or vegetative forms of microorganisms thus completely eliminating them from inanimate objects.

Difference between antiseptics and disinfection:

antiseptics	disinfection
Used for (animate) living tissue(skin)	Used for (inanimate) objects (floor, walls)

The prevention of infection in health care areas is **largely** dependent on the following:

- Rigorous adherence to the principles of aseptic techniques by all personnel who performs any invasive procedures on patients.
- Sterility of all items directly used in such procedures.
- Disinfection of all surfaces & other items in the immediate environment.
- Other methods – Prevention of SSI-Bundle of Care

Note:

SSi: Surgical Site Infection.

REMEMBER:

- There is no degree of sterility.
- An item is either sterile or non-sterile.
- It can never be relatively sterile.

Notes:

- 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:

A) Physical Methods:

1. Dry Heat or Hot air ovens, infra-red ovens .
2. Moist heat or Steam Autoclave (Available in KKHU)

B) Cool Chemical Methods:

1. Plasma Sterilizer (Sterrad®) (Available in KKHU)
2. E.O. (Ethylene Oxide) Sterilizer
3. Liquid Chemicals

C) Other Methods: Ex. Gamma Radiation and Flash Sterilization.

A) Physical Methods

Moist heat, at raised atmospheric pressure

- **Steam sterilization (steam under pressure)** - 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. **Ex. Steam autoclave**
- Method used for sterilizing surgical instruments, dressings, drapes, swabs, laps sponges, culture media, etc.



❖ 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:** Air is removed in two stages & sterilization is by pure steam. (Not available in KKHU)
- **High Vacuum / High Pressure Autoclave:** 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 KKHU)

Phases of Steam Sterilization process (5 Phases):

- ❖ **PHASE I - Loading phase:** in which the objects or packs are loaded in the sterilizer.
- ❖ **PHASE II - Heating phase:** in which the steam is brought to proper temperature & allowed to penetrate through the objects in the chamber.
- ❖ **PHASE III - Destroying phase** or time temperature cycle: in which all microbial life is exposed to the killing effect of the steam.
- ❖ **PHASE IV - Drying and cooling phase:** in which the objects are dried & cooled then, filtered air is introduced into the chamber, door is opened & packs are removed and stored.
- ❖ **PHASE V - Testing phase:** in which the efficiency of the sterilization process is checked. All mechanical parts of sterilizers, including gauges, steam lines & drains should be periodically checked by a competent biomed engineer.

Methods of Testing the Effectiveness of Autoclaves:

- **Mechanical:** chart & gauges usually carried out by Biomed Engineer.
- **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.
- **Biological: 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:

- 1) Run it empty for one cycle. (**Dummy Run**) to warm up the machine.
- 2) Put inside in the middle of the chamber, the **Bowie Dick Test Pack** and run it again and finish the whole cycle. Oh high pressure- to test leaks and presence of air. (Yellow turns **black**)
- 3) Load the items & trays for sterilization (little bit lower pressure). It is done once daily.
- 4) **Live Organism:** done once in every Sunday morning in CSSD, KKHU.

Preparation of Items before STERILIZATION:

1. Decontamination *means clean it with disinfectant*
2. Disassembly *you have to separate items*
3. Washing
4. Drying
5. Packing
6. Loading in sterilizer



Ultrasonic Washer



Automated Washer / Dryer

Making of Sterile Packs:

Should have the following external indications showing that they have been processed: *chemical indication*

- **Autoclave tapes** show a pack that has been through a 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 contents with the **processing date, autoclave used & 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 packages should be stored on open shelves. The lowest shelf should be **8 to 10 inches off the floor**. The highest shelf should be **18 inches from the ceiling**. All shelves should be at least **2 inches from the walls**.
- Either good for **30 days or 6 months to one year** depending on how the packages are wrapped & what type of wrappers used.
- **Shelf life:** refers to the length of time a package maybe considered sterile.
- Sterile packages must be stored and issued in correct order. *Order = number*
- Traceability (Tracking System). *using barcode to know where the instruments are belong to*
- Storage Room for sterile items.
- Traffic is restricted to CSSD (Central Sterile Services Department) personnel & trainees only. *We have to minimize the people who enter this area*
- One flow.
- Subjected to regular **adequate pest control** to prevent contamination from rodents, ants & cockroaches.



KKUH-CSSD Storage Room

B) Cold Methods

❖ Plasma Autoclave (Sterrad®):

- Low Temperature Hydrogen Gas Sterilizers.
- Used to sterilize delicate instruments that are heat & moisture sensitive, such as micro instruments, cameras, scopes & light cords.
- 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.
- Advantages of plasma sterilization include: speed, safety of use, & no aeration.
- Five phases to the "Sterrad®" Plasma sterilization cycle: Vacuum, injection, diffusion, plasma, vent.



❖ Chemicals:

1) Ethylene Oxide (EO): Colorless gas.

- Well established technique for sterilizing heat sensitive articles.
- Exposure period of **5 to 7 hours** is necessary for complete E.O. sterilization. *We have to remove residue of EO because it is toxic and can cause lung and skin cancer*
- Used for sterilizing vascular & bone grafts, delicate instruments, plastic articles such as disposable syringes, bacteriological media & vaccines. (Used on Commercial basis)
- Requires **6-8 hours of aeration**.

Disadvantages of EO:

- 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).

2) Liquid Chemical Sterilization:

- Liquid chemo sterilizers can destroy all forms of microbial life including bacterial, fungal spores, tubercle bacilli & viruses.
- Can be used for sterilization when steam, gas or dry heat is not indicated or available.

Common Liquid Chemicals capable of causing Disinfection / Sterilization:

- 1- **Aqueous Formaldehyde:** Oldest chemo sterilizers known to destroy spores; rarely used due to its pungent odor.
- 2- **Aqueous Glutaraldehyde:** Colorless liquid chemical with pungent odor. (CIDEX) 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.

- 3- **OPA Cidex (0.55% ortho-phthalaldehyde):** Clear, pale-blue liquid, contains 0.55% the non-glutaraldehyde solution for disinfection of flexible endoscopes and other medical devices.
- 4- **Alcohol-70 % Ethyl Alcohol & 70% Isopropyl Alcohol:** Effective & rapidly acting disinfectants. Alcohol gel preparations today have been introduced & long standing effect, fast in action & more users friendly. (Hand Antiseptics)
- 5- **Chlorexidine:** Skin antiseptic & highly active against vegetative bacteria. Ex.Chlorhexidine Hand Rub
- 6- **Hypochlorite:** Broad spectrum chlorine disinfectant effective against viruses, fungi, bacteria & spores. (Disinfectant of choice against **hepatitis B virus**).

B) Other Methods:

❖ Gamma Radiation:

- Radioactive material, such as a **Cobalt-60 source**, emits radiation (gamma rays) that effectively kills microorganisms.
- Used on commercial basis for the sterilization of a wide variety of pre-packaged hospital items and devices.
- Total sterilizing time is measured in **days**.

❖ Flash Sterilization:

- “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 for implantable devices or **as a substitute** for proper sterilization methods.

Principles of Aseptic Techniques

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.

Sterile items presented to the sterile field must be checked for:

- Package Integrity
- Expiration Date
- Chemical Process Indicator
- Tears in barriers & expired sterilization dates are considered breaks in sterility.
- Use of unsterile items contaminates 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 unsterile.

Surgical team is made up of:

- Sterile members or scrubbed personnel-work directly in the surgical field.

- Ex. Surgeons, Scrub nurse, O.R. Technician
- Non-sterile members or un-scrubbed personnel.
- Ex. Anesthetists, Circulating nurses, Anesthesia Technicians, X-Ray Technician
- ❖ Surgical team members must wear the scrub suit attire, surgical cap, and surgical face mask before performing surgical hand scrub.
- ❖ **First surgical hand scrub should be at least 5 minutes** & the subsequent hand scrub, at least 2 to 3 minutes.
- ❖ Surgical hand scrubbing to be performed prior to donning of sterile gown & sterile gloves.
- ❖ Substitute for surgical hand scrub is hand rub with 2 antiseptics (Chlorexidine & 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.



Scrubbed personnel

The sterility is limited to the portions of the gowns directly viewed by the scrubbed person. So, Gowns are considered sterile only on the:

1. Front of gown from chest to the level of the sterile field.
2. Sleeves of gown from 2 inches above the elbow to the gloved hand.

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.

Areas of gown considered unsterile are:

- 1- Gown's neckline
- 2- Shoulders
- 3- Under the arms
- 4- 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.**

Sterile drapes are used to create a sterile field:

- Surgical Drapes 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.

All items should be dispensed to the sterile field by methods that preserve the sterility of the items & integrity of the sterile field:

- After a sterile pack is opened, the edges are considered unsterile.
- Either entire bottle contents should be poured into the receptacle or remainder should be discarded.
- Solution should be poured slowly to avoid splashing. Splashing can cause strike through & contamination to the sterile field.

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.

Movement around a sterile field must not cause contamination:

- 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 & maintain a safe distance close to the sterile field.



Scrubbed personnel should:

- 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 should:

- 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.

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.

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.

There is nowhere, perhaps, it is more important to preserve the safety of the patients than in the O.R.

Lives often depend on it...

Questions

- 1) Which phase is **drying and cooling phase** in steam sterilization process?
 - a. PHASE I
 - b. PHASE II
 - c. PHASE III
 - d. PHASE IV
 - e. PHASE V

- 2) Which of the following is the disinfectant of choice against **hepatitis B virus**:
 - a. Hypochlorite
 - b. Aqueous Glutaraldehyde
 - c. Ethylene Oxide
 - d. 70% Isopropyl Alcohol

- 3) Which of the following surgical team members considered scrubbed personnel?
 - a. X-Ray Technician
 - b. O.R. Technician
 - c. Anesthesia Technician
 - d. Anesthetists

- 4) First surgical hand scrub should be at least:
 - a. 1 minute
 - b. 2-3 minutes
 - c. 5 minutes
 - d. 7 minutes



Answers:

1st Question: D

2nd Question: A

3rd Question: B

4th Question: C