



Sterilization and operating setup

Objectives:

- Acquaint with the setup in the operating room
- Describe the Fundamental principles of aseptic technique in the O.R.
- Demonstrate the correct technique of the surgical scrub, gowning & gloving technique
- Explain the importance of time out process
- Familiarize the sterilization procedures.

Resources:

- Davidson's.
- Slides
- Surgical recall.

[We highly recommend you to watch all the videos of this lecture, they are very helpful.](#)

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Once you stop learning
you start dying.

- Operating Room Orientation for Medical Students ([Video](#))

Antiseptic technique

- Terminology:

Isolation	Foundation for preventing transmission of infectious agents associated with healthcare delivery. Role: Creates a protective environment that is required to contain transmission of infectious agents
Cross Contamination	Transmission of microorganisms from patient to patient and from inanimate objects to patients
Asepsis	- Absence of microorganism that cause disease. - Freedom from infection.

- Introduction to Sterile Technique:

Proper aseptic techniques are one of the most fundamental and essential principles of infection control in the clinical and surgical setting. This stepwise process of proper aseptic technique should be performed every single time in the OR.

- Aseptic Techniques:

Methods by which contamination with microorganisms is prevented immediately before & during surgical procedures to reduce post-operative infection. These techniques are:-

1. Hand washing.	3. Surgical scrubs.	5. Using surgical barriers (surgical drapes & Personal protective equipment)
2.Surgical attire (e.g. sterile gowning and gloving).	4. Patient surgical skin prep.	6. Using safe operative techniques.

Aseptic techniques are those which:

- Remove, reduce or kill microorganisms from hands & objects.
- Employ sterile instruments.
- Reduce Patient risk of exposure to microorganisms that cannot be removed.

- Principles of Aseptic Techniques:

- Only sterile items are used within the sterile field.
- Sterile persons are gowned & gloved:
 - Gowns** are only sterile from waist to shoulder¹.
 - Gloved hands must be kept in sight at all times.**
- Only the top of a draped table is considered sterile, while The edges of anything that encloses sterile contents are considered unsterile.
(i.e. the table's top surface is sterile, the edges of the table are not sterile)
- **Sterile** people touch only **sterile** items or areas.
- **Unsterile** people avoid reaching over the **sterile** field.
- **Sterile** field is created as close as possible to the time of use.
- **Sterile** areas are continuously kept in view.
- **Sterile** persons should stay within the sterile area.
- **Destruction of the integrity of the microbial barriers results in contamination.**

¹ Armpits are not sterile, so after wearing gloves don't keep your hands under them.

Before proceeding, [here is a great video](#) that explains the scrubbing, drying, gowning and gloving techniques in 7 minutes! :) we highly recommend you to watch it!

- **The Surgical Hand Antisepsis:**

- It is the process of removing as many microorganisms as possible from the hands and arms by mechanical washing and chemical antisepsis before participating in a surgical procedure.

*Despite the mechanical action and the antimicrobial component of the scrub process, **the skin is never sterile.***

There are **4 factors** affecting the effectiveness of surgical hand antisepsis:

1. The Preparation Before Cleansing:

- Removal of finger rings, jewelry, nail polish and artificial nails.
 - A. Finger rings & jewelry can harbor microorganisms and dead skin.
 - B. Dark nail polish obscures the subungual space and likelihood of careful cleaning is reduced.

Which means when you have nail polish on, you cannot see your nails, so if you had long nails and nail polish on.. you will not be able to determine if your nails were clean or not.

- C. Artificial nail ↑ the microbial load on hands.
- Perform a preliminary handwashing with antimicrobial soap
- Wash both of your hands and arms, lathering up well, then rinse and dry
- Clean underneath your nail with a nail file

2. The Choice of Antiseptic Solution:

- Antimicrobial **soaps**, aqueous **scrubs** (e.g. biguanides²), and alcohol **rubs** are used as antiseptic solutions.
- Alcoholic **chlorhexidine** was found to have greater residual antimicrobial activity.
 - * Review by *Tanner et al*, reported that **biguanides** (e.g. Chlorhexidine gluconate) are more effective in removing microorganisms on hands than **iodophors** (e.g. Povidone iodine)

3. The Cleansing Method:

- All are performed using a surgical scrub brush and an antimicrobial soap solution. (See *Surgical Scrub Procedure Below*)
You only need to scrub for the first time in the day , then next times you can use alternatives (e.g. Chlorhexidine)

4. The Duration for Hand Cleansing:

- All surgical scrubs are **3-5 minutes** in length.

² In case you recall metformin (antihyperglycemic), it's another derivative of biguanides, along with Chlorhexidine (disinfectant).

Surgical Scrub Procedure (video)

1. Remove sterile disposable brush-sponge from its wrapper and moisten the sponge.
2. Lather fingertips with **sponge** side of brush, then -using **brush** side of the brush- scrub the spaces under the fingernails of the right or left hand with 30 circular strokes.
3. Lather digits; scrub 20 circular strokes on all four sides of each finger.
4. Lather palm, back of hand, heel of the hand and space between thumb & index finger (*scrub 20 circular strokes on each surface*)
5. Forearm scrub; divide the forearm into 3 inch increments (*the brush is 3 inches lengthwise*)
 - Use the sponge side of the brush lengthwise to apply soap around the wrist.
 - Scrub 20 circular strokes on all four sides of the wrist, then move up the forearm.
 - Lather, then scrub ending 2 inches **above the elbow**.
6. Repeat the previous steps for the other arm.
7. Discard the brush.
8. Rinse (**don't rub, just rinse**) hands and arms without retracing or contaminating; allow the water to drip from the elbows. After final rinse, turn water off and keep scrubbed hands and arms in view *to avoid* contamination and back into operating room.

Q: What is the best technique for you to use when rinsing your hands and forearms after a surgical scrub?

A: **Rinsing should start with the hand positioned such that the water runs off the elbow rather than down to the hands. So your fingers won't be contaminated - hopefully-**.
9. In the operating room, dry hands and arms with a sterile towel before donning (wearing) a sterile surgical gown & glove (*steps below*)

Drying the Hands (video)

<p>Step 1: Reach down to the opened sterile package containing the gown, and pick up the towel.</p> <ul style="list-style-type: none"> - <i>Be careful not to drip water onto the pack.</i> 	<p>Step 3: Dry both hands thoroughly <u>but</u> independently.</p> <ul style="list-style-type: none"> - <i>To dry one arm, hold the towel in the opposite hand and using the oscillating (circular) motion³ of the arm, draw the towel up to the elbow.</i>
<p>Step 2: .Open the towel full-length, holding one end away from the non-sterile scrub attire.</p> <ul style="list-style-type: none"> - <i>Bend slightly forward.</i> 	<p>Step 4: Carefully reverse the towel, still holding it away from the body.</p> <ul style="list-style-type: none"> - <i>Dry the opposite arm on the unused end of the towel.</i>

Gowning Technique (video)

<p>Step 1: Reach down to the sterile package and lift the folded gown directly upward.</p>	<p>Step 3: Holding the folded gown, carefully locate the neckline.</p>
<p>Step 2: Step back away from the table into an unobstructed area to provide a wide margin of safety while gowning.</p>	<p>Step 4: Holding the inside front of the gown just below the neckline with both hands, let the gown unfold, keeping the inside of the gown towards the body.</p> <ul style="list-style-type: none"> - <i>Don't touch the outside of the gown with bare hands→ gown is considered contaminated.</i>
<p>Step 5: Holding the hands at shoulder level, slip both arms into the armholes simultaneously.</p> <p>The circulator (OR nurse) brings the gown over the shoulders by reaching inside to the shoulders and arm seams,</p> <ul style="list-style-type: none"> - The gown is pulled on, leaving the cuffs of the sleeves extended over the hands. - The back of the gown is securely tied or fastened at the neck and waist, touch the outside of the gown at the line of ties or fasteners in the back only. 	

³ Similarly to watch indicator motion.

Cleaning, Disinfection and Sterilization

● Terminology:

1. **Cleaning** is the physical removal of organic material (blood and proteins) or soil from objects, is usually done using water with or without detergents.
2. **Disinfection** is defined as the intermediate measures between physical cleaning and sterilization, is carried out with pasteurization or chemical germicides.
3. **Sterilization** is the destruction of all forms of microbial life; it is carried out in the hospital with steam under pressure, liquid or gaseous chemicals, or dry heat.

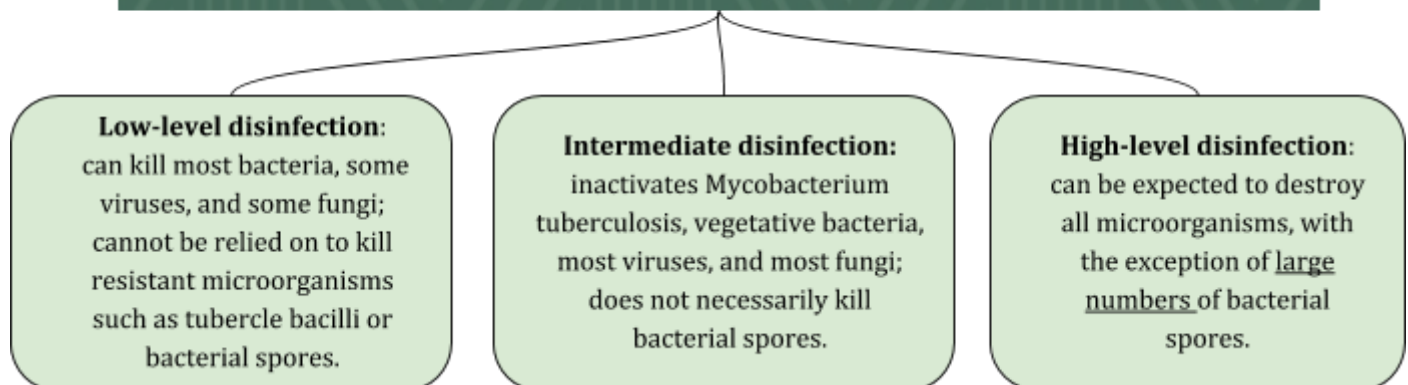
● Cleaning:

Items must be thoroughly cleaned before processing, because:

1. Organic material (e.g., blood and proteins) may contain high concentrations of microorganisms.
2. Such organic material may inactivate chemical germicides and protect microorganisms from the disinfection or sterilization process.

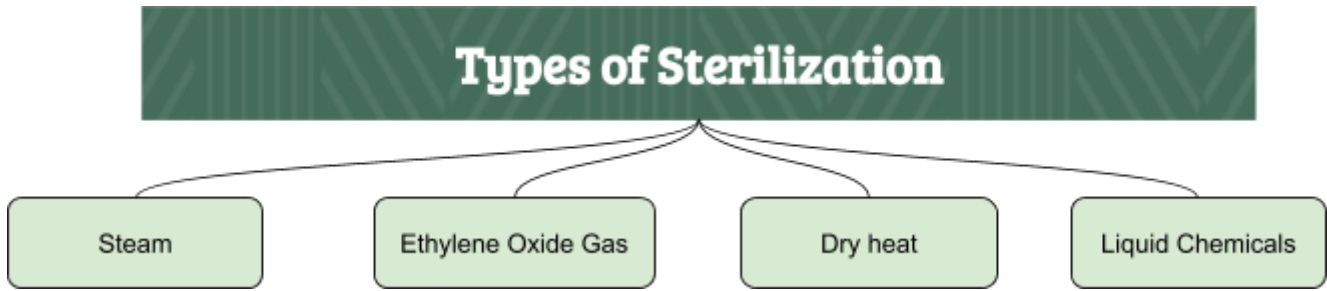
● Disinfection:

Types of disinfection



- The level of disinfection achieved depends on several factors, including: **contact time**, **temperature**, type and concentration of the active ingredients of the **chemical germicide**, the **nature of the microbial contamination**.
- Selection of germicide: The most appropriate chemical germicide for a particular situation can be selected by responsible personnel in each hospital based on: **the object** to be disinfected, the **level** of disinfection needed, **the scope** of services, physical facilities, and personnel available in hospital.
- Gloves may be indicated to prevent skin reactions when some chemical disinfectants are used.
- Items subjected to high-level disinfection with liquid chemicals need to be rinsed in sterile water to remove toxic or irritating residues and then thoroughly dried. Subsequently, the objects need to be handled aseptically with sterile gloves and towels and stored in protective wrappers to prevent recontamination

- **Sterilization:**



1. Steam sterilization:

- **Steam sterilization is the most inexpensive and effective method for sterilization.**
- Steam sterilization is unsuitable for processing plastics with low melting points, powders, or anhydrous oils.
- Items that are to be sterilized but not used immediately need to be wrapped for storage.
- Sterility can be maintained in storage for various lengths of time, depending on the type of wrapping material, the conditions of storage, and the integrity of the package

Monitoring of steam sterilization processes	Microbiological monitoring
I. To check the highest temperature that is reached during sterilization and the length of time that this temperature is maintained. II. Heat- and steam-sensitive chemical indicators can be used on the outside of each pack, a large pack might have a chemical indicator both on the outside and the inside to verify that steam has penetrated the pack	I. Microbiological monitoring of steam sterilizers is recommended at least once a week with commercial preparations of spores of Bacillus stearothermophilus (a microorganism having spores that are particularly resistant to moist heat, thus assuring a wide margin of safety). II. One positive spore test (spores not killed) does not necessarily indicate that items processed in the sterilizer are not sterile, but it does suggest that the sterilizer should be rechecked for proper temperature, length of cycle, loading, and use and that the test be repeated.

Sterilization of implantable items:

- Implantable items , such as orthopedic devices, require special handling before and during sterilization; thus, packs containing implantable objects need to be clearly labeled so they will be appropriately processed.
- To guarantee a wide margin of safety, it is recommended that each load of such items be tested with a spore test and that the sterilized item not be released for use until the spore test is negative at 48 hours .
- If it is not possible to process an implantable object with a confirmed 48-hour spore test before use, it is recommended that the unwrapped object receive the equivalent of full-cycle steam sterilization and **not flash sterilization** (involving rapid penetration of steam).

2. Ethylene oxide gas sterilization.

- It is a more complex & expensive process than steam sterilization.
- It is usually restricted to objects that might be damaged by heat or excessive moisture.
- Before sterilization, objects also need to be cleaned thoroughly and wrapped in a material that allows the gas to penetrate.
- Because ethylene oxide gas is toxic, precautions (e.g., local exhaust ventilation⁴) should be taken to protect personnel. All objects processed by gas sterilization also need special aeration according to manufacturer's recommendations before use to remove toxic residues of ethylene oxide.
- [Chemical indicators](#) need to be used with each package to show that it has been exposed to the gas sterilization process.
- Moreover, it is recommended that gas sterilizers be checked at least once a week with commercial preparations of spores, usually **Bacillus subtilis**.

3. Dry heat

- Powders and anhydrous oils can be sterilized by dry heat .
- Microbiological monitoring of dry heat sterilizers usually provides a wide margin of safety.

4. Liquid chemicals

- **Liquid chemicals can be used for sterilization and disinfection when steam, gas, or dry heat sterilization is not indicated or available**

Medical devices, equipment, and surgical materials are divided into three general categories based on the potential risk of infection involved in their use:

1. Critical items	<ul style="list-style-type: none">• Critical items are instruments or objects that are introduced directly into the bloodstream or into other normally sterile areas of the body.• Examples are surgical instruments, cardiac catheters, implants, pertinent components of the heart-lung oxygenator, and the blood compartment of a hemodialyzer.• Sterility at the time of use is required for these items; consequently, one of several accepted sterilization procedures is generally recommended.
2. Semicritical items	<ul style="list-style-type: none">• These items come in contact with intact mucous membranes, but they do not ordinarily penetrate body surfaces.• Examples are noninvasive flexible and rigid fiberoptic endoscopes, endotracheal tubes, anesthesia breathing circuits, and cystoscopes.• Sterilization is not absolutely essential; at a minimum, a high-level disinfection procedure. In most cases, meticulous physical cleaning followed by an appropriate high-level disinfection treatment gives the user a reasonable degree of assurance that the items are free of pathogens.
3. Noncritical items	<ul style="list-style-type: none">• Noncritical items are those that either do not ordinarily touch the patient or touch only intact skin.• Such items include crutches, bedboards, blood pressure cuffs, and a variety of other medical accessories.• These items rarely, if ever, transmit disease. Consequently, washing with a detergent may be sufficient <p>For noncritical items, cleaning can consist only of:</p> <ol style="list-style-type: none">1) washing with a detergent or a disinfectant-detergent2) rinsing3) thorough drying

⁴ designed to reduce employee exposure to airborne contaminants (dust, mist, fume, vapour, gas) in the workplace by capturing the emission at source and transporting it to a safe emission point or to a filter/scrubber.

Summary

To wrap up, general recommendations when it comes to cleaning, disinfection, and sterilization:

Cleaning	All objects to be disinfected or sterilized should first be thoroughly cleaned to remove all organic matter (blood and tissue) and other residue.
Indications for Sterilization and High-Level Disinfection	<ol style="list-style-type: none"> 1. Critical medical devices or patient-care equipment that enter normally sterile tissue or the vascular system or through which blood flows should be subjected to a sterilization procedure before each use. 2. Laparoscopes, arthroscopes, and other scopes that enter normally sterile tissue should be subjected to a sterilization procedure before each use; if this is not feasible, they should receive at least high-level disinfection. 3. Equipment that touches mucous membranes, e.g., endoscopes, endotracheal tubes, anesthesia breathing circuits, and respiratory therapy equipment, should receive high-level disinfection.
Methods of Sterilization	<ul style="list-style-type: none"> • Whenever sterilization is indicated, a steam sterilizer should be used unless the object to be sterilized will be damaged by <u>heat, pressure, or moisture</u> or is otherwise inappropriate for steam sterilization. In this case, another acceptable method of sterilization should be used. • Flash sterilization [270°F (132°C) for 3 minutes in a gravity displacement steam sterilizer] is not recommended for implantable items.
Biological Monitoring of Sterilizers	<ul style="list-style-type: none"> • All sterilizers should be monitored at least <u>once a week</u> with commercial preparations of spores intended specifically for that type of sterilizer (i.e., Bacillus stearothermophilus for steam sterilizers and Bacillus subtilis for ethylene oxide and dry heat sterilizers). • <u>Every load that contains implantable objects</u> should be monitored. These implantable objects should not be used until the spore test is found to be negative at 48 hours. • If spores are not killed in routine spore tests, the sterilizer should immediately be checked for proper use and function and the spore test repeated. Objects, other than implantable objects, do not need to be recalled because of a single positive spore test unless the sterilizer or the sterilization procedure is defective. • If spore tests remain positive, use of the sterilizer should be discontinued until it is serviced.
Use and Preventive Maintenance	Manufacturer's instructions should be followed for use and maintenance of sterilizers.
Chemical Indicators	Chemical indicators that will show a package has been through a sterilization cycle should be visible on the outside of each package sterilized.
Use of Sterile Items	An item should not be used if its sterility is questionable, e.g., its package is punctured, torn, or wet.
Reprocessing Single-Use or Disposable Items	<ul style="list-style-type: none"> • Items or devices that cannot be cleaned and sterilized or disinfected without altering their physical integrity and function should not be reprocessed. • Reprocessing procedures that result in residual toxicity or compromise the overall safety or effectiveness of the items or devices should be avoided.

- **Role of CSSD (Central sterile services department):**

Rinsing, Cleaning, Drying, Inspection and assembly, Packaging, Labelling, Sterilisation, Storage, Distribution.