



# Sterilization and operating setup

## Objectives:

1. Acquaint with the setup in the operating room
2. Describe the fundamental principles of aseptic technique in the O.R
3. Demonstrate the correct technique of the surgical scrub, growing and gloving technique
4. Explain the importance of time out process
5. Familiarize the sterilization procedure.



**The videos in this lecture are very helpful so we recommend you to watch them.**

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# Important Questions!

## 1- The definition of asepsis is:

- A. Soiled or infected with organisms
- B. Capable of producing disease
- C. Absence of microorganisms

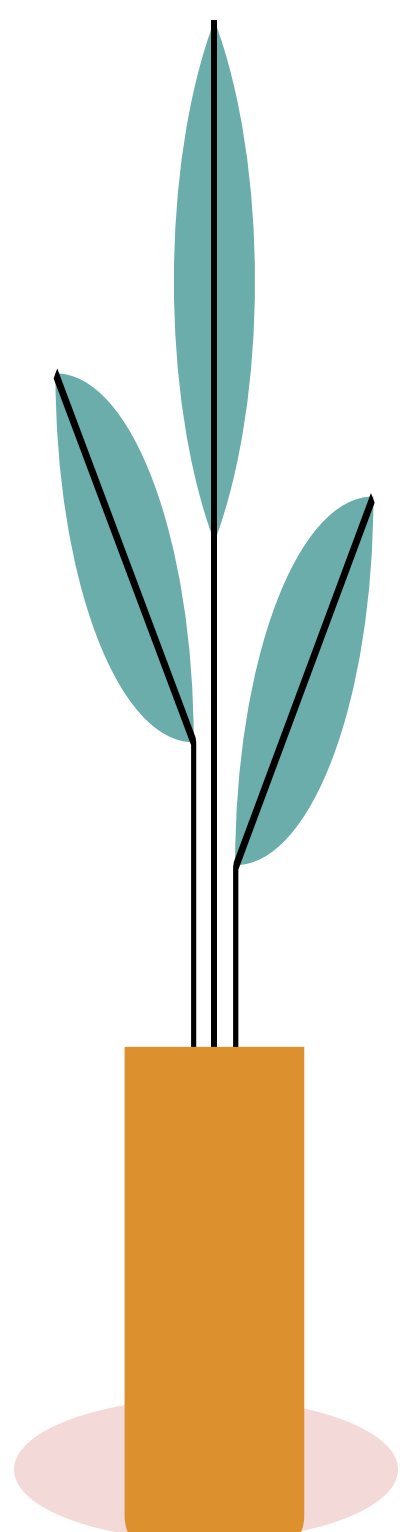
## 2- Cross contamination is defined as:

- A. Producing or capable of producing disease
- B. Transmission of microorganisms from patient to patient and from inanimate objects to patients
- C. Severe toxic state resulting from infection with pyogenic organisms

## 3- Which is the best technique for you to use when rinsing your hands and forearms after a surgical scrub?

- A. Rinsing is not performed after a surgical scrub because it will reduce the antimicrobial activity of the cleansing solution
- B. Rinsing should start at the elbow with the water running down back down to the hand
- C. Rinsing should start with the hand positioned such that the water runs off the elbow rather than down to the hands

Answers: 1-C , 2-B , 3-C





## Antiseptic technique

### Terminology:

Isolation	Foundation for <u>preventing</u> transmission of infectious agents <u>associated</u> 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	<ul style="list-style-type: none"><li>- Absence of microorganism that cause disease.</li><li>- Freedom from infection.</li></ul>

### Introduction to Sterile(aseptic) Technique:

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



# Antiseptic technique

## Aseptic Techniques:

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

### Which are:-

- Hand washing.
- Surgical attire (e.g. sterile gowning and gloving).



OR scrubs should be Green or Light blue. You should wear a shoe cover and change the scrubs you wear from home.

- Surgical scrubs.
- Patient surgical skin prep.

E.g. To clean the abdomen we use an antiseptic agent (Povidone Iodine or Chlorhexidine) starting from the point of incision outward in a circular motion. So the goal here is to clean the patient's skin and remove the microorganisms



- Using surgical barriers (surgical drapes: minimize the passage of microorganisms from non-sterile to sterile areas & PPE which is Personal protective equipment)

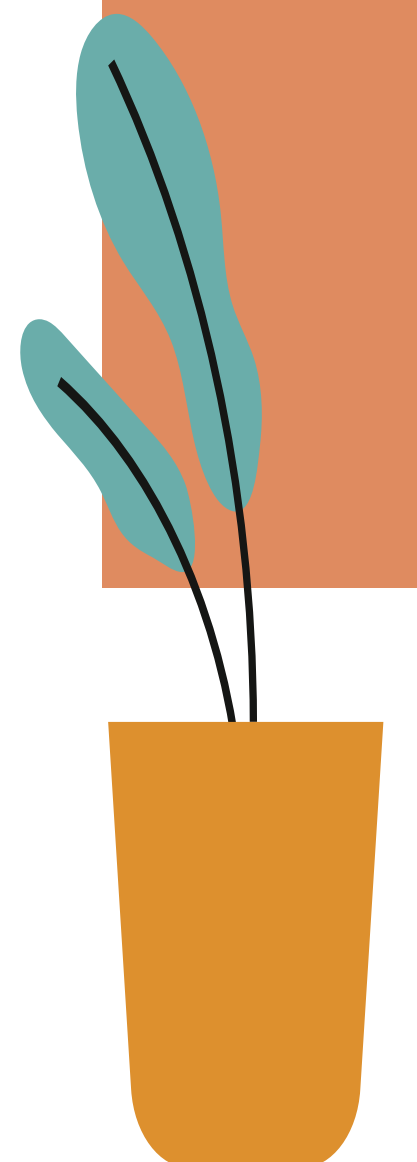


- Using safe operative techniques.



## 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.

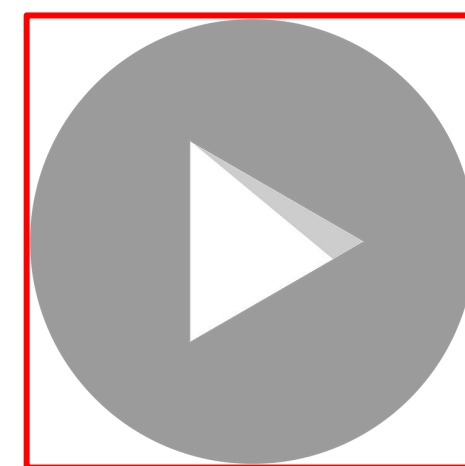


# Antiseptic technique

## Principles of Aseptic Techniques:

- **Sterile** people touch only **sterile** items or areas.
- **Unsterile** people **avoid** 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.
- Only sterile items are used within the sterile field.
- Sterile persons are gowned & gloved:
  - I. **Gowns** are only sterile from **waist to shoulder**.
  - II. **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 it is not sterile).

Before proceeding, here is a great video that explains the scrubbing, drying, gowning and gloving techniques in 7 minutes



## 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:

### 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. biguanides ), and alcohol rubs are used as antiseptics 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 next slide)

## 4. The Duration for Hand Cleansing:

- All surgical scrubs are 3-5 minutes in length.
- 5 minutes is the most important, 2.5 minutes for each hand.
- Hand washing: 40-60 seconds
- Hand rub: 20-30 seconds



## Surgical Scrub Procedure:

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.

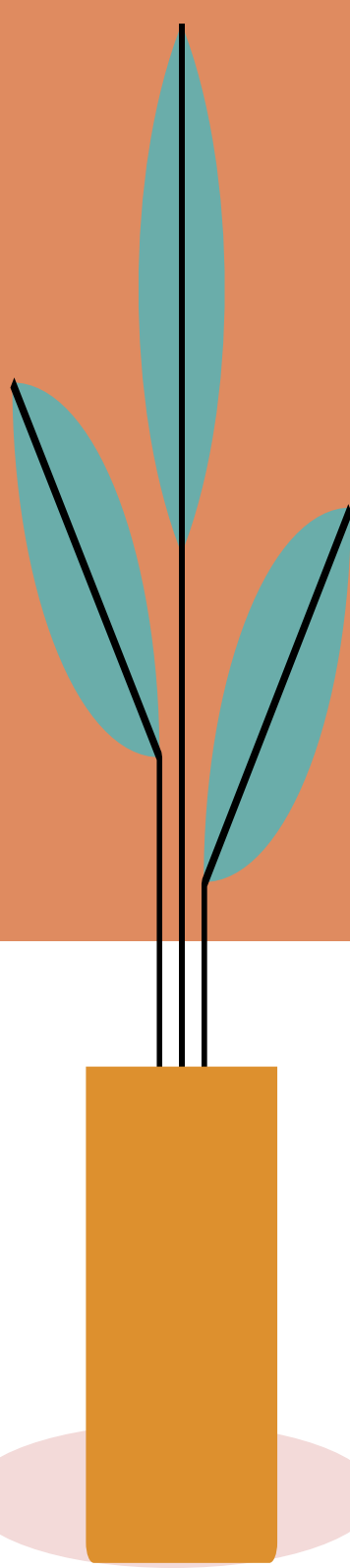
7. Discard the brush.

8. Rinse 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? VERY IMPORTANT

**A:** Rinsing should start with the hand positioned such that the water runs off the elbow rather than down to the hands.

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:

**Step 1:** Reach down to the opened sterile package containing the gown, and pick up the towel.

- Be careful not to drip water onto the pack.

**Step 2:** Open the towel full-length, holding one end away from the non-sterile scrub attire.

- Bend slightly forward.

**Step 3:** Dry both hands thoroughly but independently.

- To dry one arm, hold the towel in the opposite hand and using the oscillating (circular) motion of the arm, draw the towel up to the elbow.

**Step 4:** Carefully reverse the towel, still holding it away from the body.

- Dry the opposite arm on the unused end of the towel



## Gowning Technique:

**Step 1:** Reach down to the sterile package and lift the folded gown directly upward.

**Step 2:** : Step back away from the table into an unobstructed area to provide a wide margin of safety while gowning.

**Step 3:** Holding the folded gown, carefully locate the neckline.

**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.

- **Don't touch the outside of the gown with bare hands**→ gown is considered contaminated.

**Step 5:** : Holding the hands at shoulder level, slip both arms into the armholes simultaneously. The circulator (OR nurse) brings the gown over the shoulders by reaching inside to the shoulders and arm seams,

- 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.**



## Recall:

### How do I stand if I am waiting for a case to start?

Hands together in front, above your waist.

## ● Summary of gowning principles:

- Touch only the inside of the gown while donning it.
- If outside is touched, gown is considered contaminated.
- Scrubbed hands and arms are considered contaminated if they fall below the waist level or touch the body
- After donning the gown, the only parts of the gown that are considered sterile are the sleeves and front from the waist level to a few inches below the neck opening.



## Gloving by the Closed Technique

- Preferred method over open-gloving technique
- Provides a bacterial barrier between patient and surgeon

**Step 1:** Using the right hand (In gloving start with dominant hand) and keeping it within the cuff of the sleeve, pick up the left glove from the inner wrap of the glove package by grasping the folded cuff.

**Step 3:** Grasp the back of the cuff in the left hand and turn it over the end of the left sleeve & hand.

- The cuff of the glove is now over the stockinette cuff of the gown, with the hand still inside the sleeve

**Step 2:** Extend the left forearm with the palm upward.

- Place the palm of the glove against the palm of the left hand, grasping in the left hand the top edge of the cuff, above the palm.

**- In correct position, glove fingers are pointing toward you & the thumb of the glove is down.**

**Step 4:** Grasp the top of the left glove and underlying gown sleeve with the covered right hand.

- Pull the glove on over the extended right fingers until it completely covers the stockinette cuff.

**Step 5:** Glove the right hand in the same manner. Use the gloved left hand to pull on the right glove.



## Final Tie of the Gown



# 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.(so here we try to reduce the amount of microbes to minimum level).

3. **Sterilization is the destruction of all forms of microbial life**; it is carried out in the hospital with steam under pressure (autoclave), 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: Mostly used for scopes

### Types of disinfection

#### High-level disinfection:

can be expected to destroy all microorganisms, with the exception of large numbers of bacterial spores.

#### Intermediate disinfection:

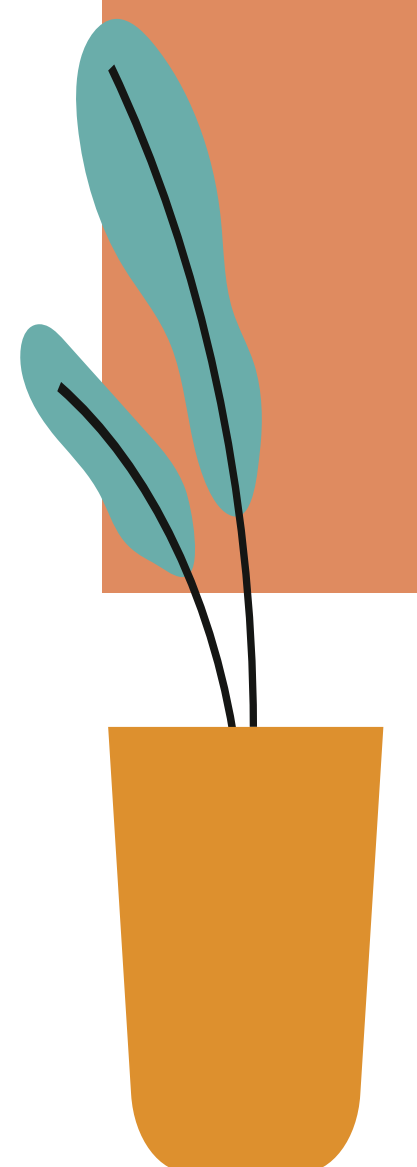
inactivates Mycobacterium tuberculosis, vegetative bacteria, most viruses, and most fungi; does not necessarily kill bacterial spores.

#### Low-level disinfection:

can kill most bacteria, some viruses, and some fungi; cannot be relied on to kill resistant microorganisms such as tubercle bacilli or bacterial spores.

## ● The level of disinfection achieved depends on several factors:

1. Contact time.
2. Temperature.
3. Type and concentration of the active ingredients of the **chemical germicide**.
4. the nature of the **microbial contamination**.



- **Sterilization:** Mostly used for instruments

## Types of sterilization

1. Steam sterilization:	2. Ethylene oxide gas sterilization	3. Dry heat	4. Liquid chemicals
<p style="color: red; text-align: center;"><b>- Steam sterilization is the most inexpensive and effective method for sterilization.</b></p> <p style="color: gray;">- Steam sterilization is unsuitable for processing plastics with low melting points, powders, or anhydrous oils</p>	<p>- It is a more complex &amp; expensive process than steam sterilization.</p> <p>- It is usually restricted to objects that might be damaged by heat or excessive moisture.</p> <p>- Before sterilization, objects also need to be cleaned thoroughly and wrapped in a material that allows the gas to penetrate.</p>	<p>- Powders and anhydrous oils can be sterilized by dry heat.</p> <p>- Microbiological monitoring of dry heat sterilizers usually provides a wide margin of safety.</p>	<p>- Liquid chemicals can be used for <u>sterilization and disinfection</u> when steam, gas, or dry heat sterilization is <u>not</u> indicated or available</p>

- **Sterilization of implantable items:**

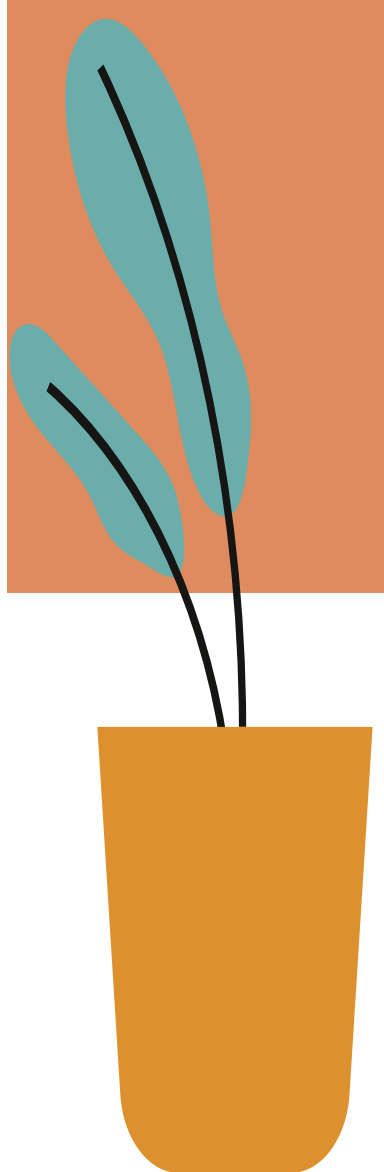
- Implantable items , such as orthopedic devices, require special handling before and during sterilization; thus, packs containing implantable objects need to be clearly labeled so they will be appropriately processed.
- To guarantee a wide margin of safety, it is recommended that each load of such items 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).



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	2. Semicritical items	3. Noncritical items
<ul style="list-style-type: none"> <li>● Critical items are instruments or objects that are introduced directly into the bloodstream or into other normally sterile areas of the body.</li> <li>● Examples are surgical instruments, cardiac catheters, implants, pertinent components of the heart-lung oxygenator, and the blood compartment of a hemodialyzer.</li> <li>● Sterility at the time of use is required for these items; consequently, one of several accepted sterilization procedures is generally recommended.</li> </ul>	<ul style="list-style-type: none"> <li>● These items come in contact with intact mucous membranes, but they do not ordinarily penetrate body surfaces.</li> <li>● Examples are noninvasive flexible and rigid fiberoptic endoscopes, endotracheal tubes, anesthesia breathing circuits, and cystoscopes.</li> <li>● 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.</li> </ul>	<ul style="list-style-type: none"> <li>● Noncritical items are those that either do not ordinarily touch the patient or touch only intact skin.</li> <li>● Such items include stethoscopes, crutches, bedboards, blood pressure cuffs, and a variety of other medical accessories.</li> <li>● These items rarely, if ever, transmit disease. Consequently, washing with a detergent may be sufficient <u>For noncritical items, cleaning can consist only of:</u> <ol style="list-style-type: none"> <li>1) washing with a detergent or a disinfectant-detergent</li> <li>2) rinsing</li> <li>3) thorough drying</li> </ol> </li> </ul>



# Summary

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

<b>Cross Contamination</b>	Transmission of microorganisms from patient to patient and from inanimate objects to patients .
<b>Asepsis</b>	Absence of microorganism that cause disease.
<b>Best technique for you to use when Rinsing your hands and forearms after a surgical scrub</b>	Rinsing should start with the hand positioned such that the water runs off the elbow rather than down to the hands.

- **Sterilization:** is the destruction of all forms of microbial life.
- Proper aseptic techniques are one of the most fundamental and essential principles of infection control in the clinical and surgical setting (prevent surgical site infections).
- Destruction of the integrity of the microbial barriers results in contamination.
- All surgical scrubs are 3-5 minutes in length.

- **Aseptic Techniques:**

Methods by which contamination with microorganisms is prevented:

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

- **Types of disinfection:**

1. **Low-level disinfection:**

can kill most bacteria, some viruses, and some fungi; cannot be relied on to kill resistant microorganisms such as tubercle bacilli or bacterial spores.

2. **Intermediate disinfection:**

inactivates Mycobacterium tuberculosis, vegetative bacteria, most viruses, and most fungi; does not necessarily kill bacterial spores.

3. **High-level disinfection:** can be expected to destroy all microorganisms, with the exception of large numbers of bacterial spores.

**Medical devices and equipments are divided into three general categories:**

1. Critical items	2. Semicritical items	3. Noncritical items
<ul style="list-style-type: none"> <li>● Examples are surgical instruments, cardiac catheters, implants, pertinent components of the heart-lung oxygenator, and the blood compartment of a hemodialyzer.</li> </ul>	<ul style="list-style-type: none"> <li>● Examples are noninvasive flexible and rigid fiberoptic endoscopes, endotracheal tubes, anesthesia breathing circuits, and cystoscopes.</li> </ul>	<ul style="list-style-type: none"> <li>● Such items include stethoscopes, crutches, bedboards, blood pressure cuffs, and a variety of other medical accessories.</li> </ul>

# Quiz

1. **Despite the antimicrobial component of the scrub process:**

- A. Skin is always sterile.
- B. Skin is never sterile.
- C. Skin is sterile after scrub process.

2. **Gowns are only sterile from:**

- A. From waist to shoulder.
- B. From chest to knees.
- C. From waist to knees.

3- **First surgical hand scrub should be at least:**

- a. 1 minute
- b. 2-3 minutes
- c. 5 minutes
- d. 7 minutes

4- **the most inexpensive and effective method for sterilization:**

- a. Steam sterilization
- b. Ethylene oxide gas sterilization.
- c. Dry heat
- d. Liquid chemicals

5. **Which of the following is an example of Noncritical items:**

- a. cystoscopes
- b. cardiac catheters
- c. heart-lung oxygenator
- d. blood pressure cuffs

6. **Which of the following types of disinfection can be expected to destroy all microorganisms, with the exception of large numbers of bacterial spores:**

- a. High-level disinfection
- b. Intermediate disinfection
- c. Low-level disinfection

Answers:

1:B 2:A 3:C 4:A 5:D 6:A

