

Hospital Acquired Infection (HAI) and Infection Prevention Control (IPC)

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HAI

-
- Also called **Nosocomial infection**
 - An infection occurring in a patient during the patient care in a health care facility which was not present or incubating at the time of admission.
 - Symptoms should appear at least after 48 hours of admission.
 - This includes infections acquired in a hospital but appear after discharge.

Sources of HAIs

Endogenous: Patients own normal flora (50%)

Example:

Urinary catheter

IV cannula

Central venous catheter

Endotracheal tubes

Ventilators

Cont.....

- **Exogenous:**

- Air (5%)

- Instruments (10%)

- Other patient/stuff- Cross infection (35%)

Cont.....

-
- **How to prevent Endogenous infection**
 - Use the device as little as possible
 - Use only when necessary
 - Take it out without delay when the need is over
 - Maintain aseptic technique
 - **How to prevent Exogenous infection**
 - Hand hygiene
 - Environment cleaning

Common HAI

The Center for Disease Control and Prevention (**CDC**) categorizes nosocomial infections, broadly into the following 4 most frequent types:

- **Urinary tract infection (UTI)**
 - **Catheter associated urinary tract infection (CAUTI)**
- **Respiratory tract infection (RTI)**
 - **Ventilator associated pneumonia (VAP)**
- **Blood stream infection (BSI)**
 - **Central line-associated bloodstream infection (CLABSI)**
- **Surgical site infection (SSI)**

Common organisms of HAI

□ Gram positive bacteria

- *Staphylococcus aureus*
- CoNS (Coagulase negative Staphylococcus)
- *Enterococcus*
- *Streptococcus spp.*

□ Gram negative bacteria

- *Klebsiella*
- *E. coli*
- *Pseudomonas*
- *Acinetobacter*
- *Haemophilus influenza*

Cont.....

❑ Fungus

- *Candida spp.*
- *Aspergillus spp.*

❑ Viruses-

- Hepatitis A
- Hepatitis B, C
- Human Immunodeficiency virus(HIV)

Risk factors associated with HAI

- Duration of hospital stay
- Invasive procedures
- Admission in ICU
- Neutropenia
- Immunosuppressed condition
- Too young/too old

CDC endorses 2 types of Precautions

- **Standard precautions**
- **Transmission-based precautions**
 - Contact
 - Droplet
 - Airborne

Cont.....

Standard precautions

- **Basic** infection prevention practices

Transmission-Based Precautions: Used in addition to Standard Precautions

- When patients harbor **MDR** or **dangerous** organisms that can spread through
 - contact
 - droplet
 - airborne

Components of Standard Precautions

1. **Hand hygiene**
2. Use of Personal protective equipments (**PPE**)
3. Respiratory hygiene/**cough etiquette**
4. Patient care equipments: **Disinfection and sterilization**
5. Safe handling of **sharps**
6. Safe **injection** practice
7. **Environment** cleaning/Spillage management/Linen management
8. Disposal of **Hospital wastes**

Hand Hygiene

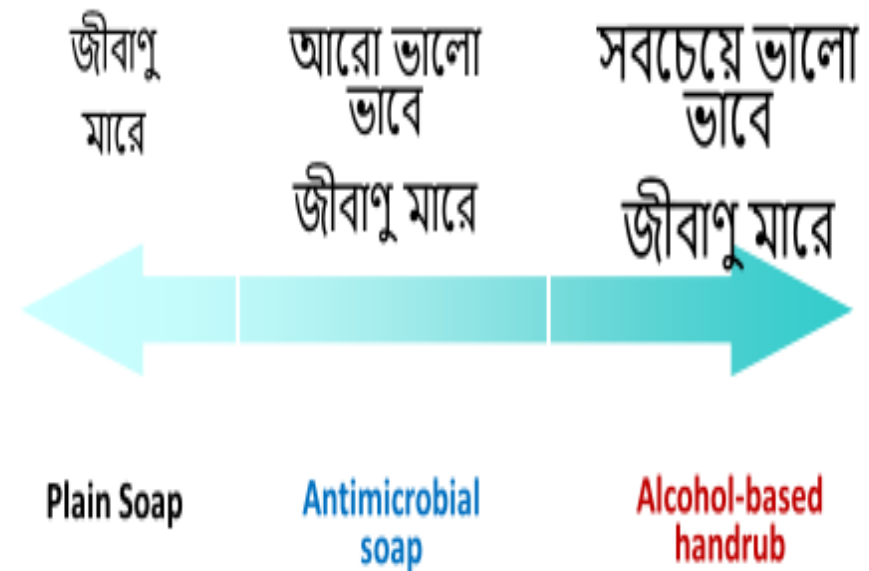
When to wash hands?

- When hands are visibly dirty
- Before and after touching a patient
- After removing gloves
- After contact with body fluids
- Before procedures
- Before handling, serving or eating food
- After touching patient's surroundings
- After personal body functions
- At the start and end of duty

Materials used in hand wash

- Plain soap and water
- Antimicrobial soap and water
Dettol soap, Savlon soap, disinfectant soap
- Alcohol-based hand rub

Bacteria killing capacity





Rub hands palm to palm



Rub the back of both hands



Palm to palm with fingers interlaced



Back of fingers to opposing palm, with fingers interlocked



Rotational rubbing of right thumb clasped in left palm. Vice versa



Rotational rubbing backward and forward with clasped fingers of left hand in right palm. Vice versa



Wrap left hand over right wrist using rotational movements up to mid forearm. Vice versa

7 STEPS TO HAND HYGIENE

Hand Washing



Most frequently missed areas (if not washed properly)

How to Promote this practice

- Training
- Routine observation /feedback
- Good role model
- Patient education

আগে হাত ধুয়ে আসুন।

তার পর আমাকে স্পর্শ
করবেন

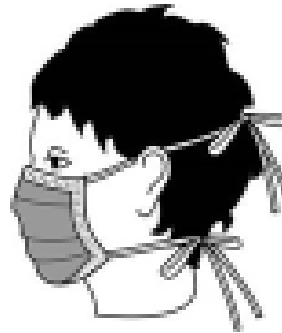
I'm waiting for the day when



Use of Personal Protective Equipments (PPE) in Standard Precaution



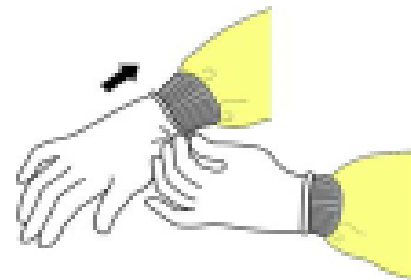
Gown



Mask



Eye protector



Gloves



Shoe cover

Dress & Attire

When you arrive at the hospital, you have to-

- Remove outdoor clothes & jwelleries
- wear the selected dress for hospital
- clean hands with soap & water

Now, you are ready for your work.

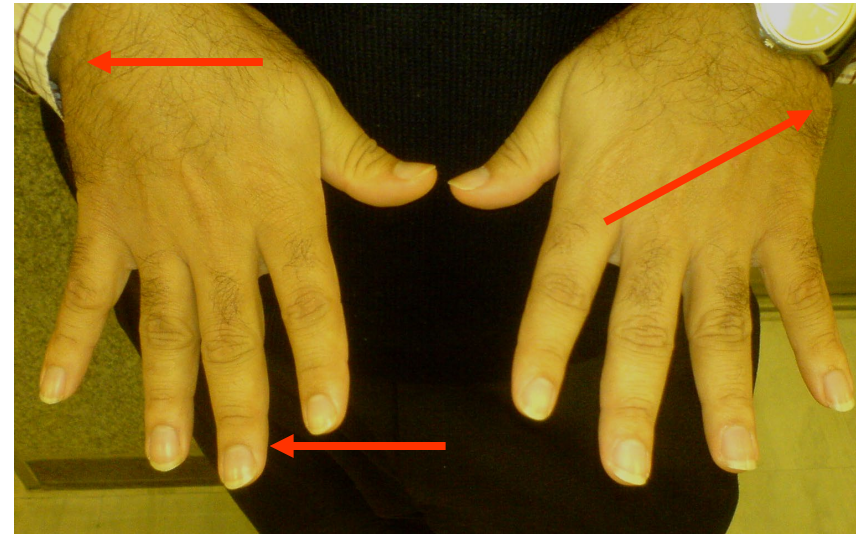


Dress & Attire

Female Doctors



Male Doctors



(Not Recommended)

Respiratory hygiene: Necessary when the patient is spreading infection through **respiratory route**

1. Use **paper towel** while coughing or sneezing
2. Immediately **wash hands** with alcohol
3. Wear **masks** when going out of the room

Cough etiquette

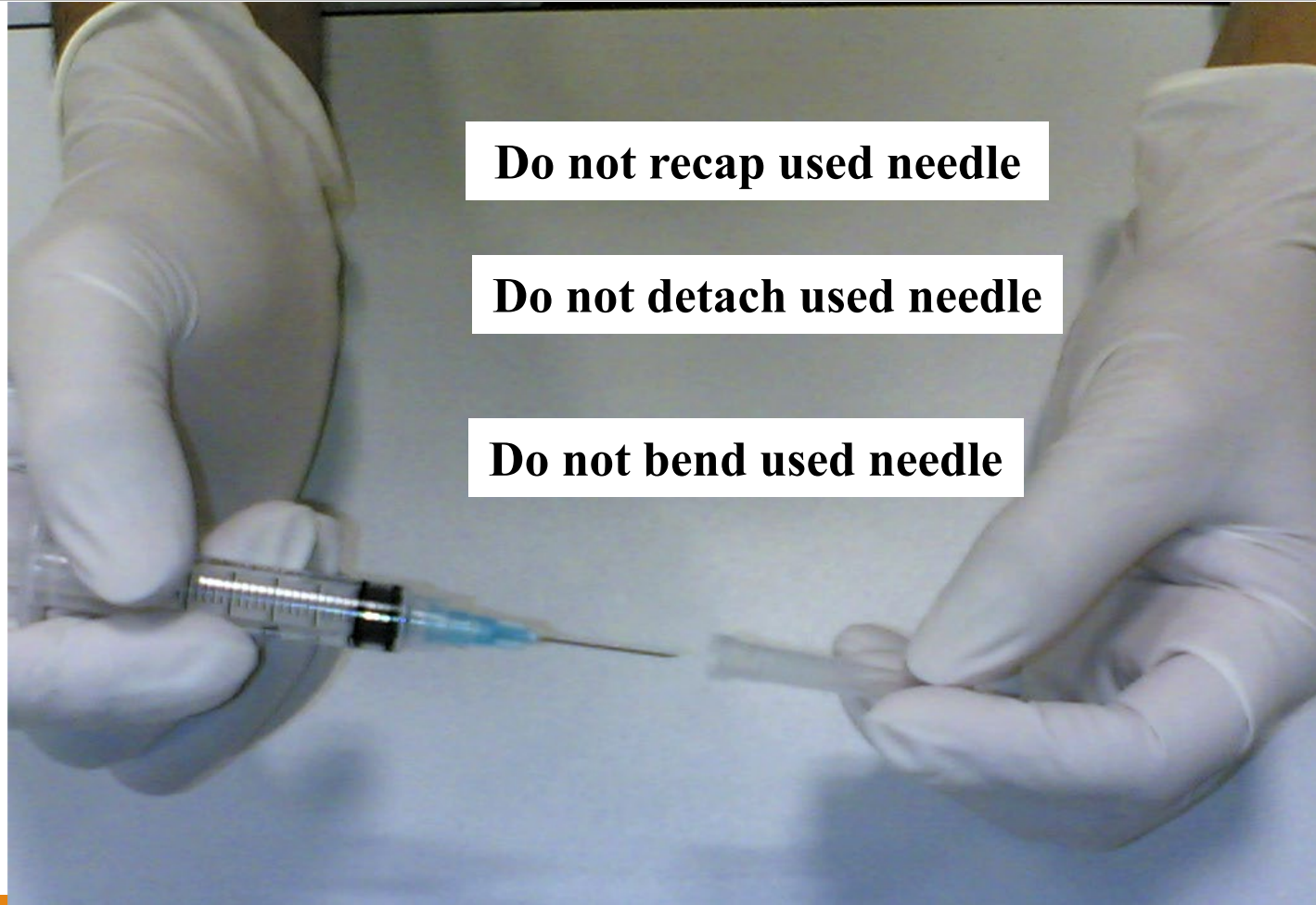
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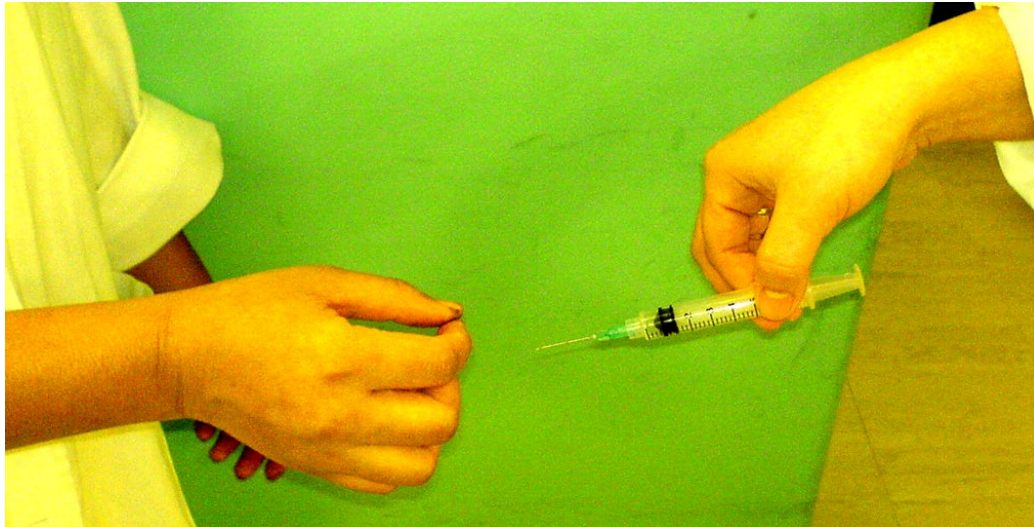


Management of sharp Instruments



Avoidance of sharp injuries





ধারালো জিনিস এভাবে দেওয়া
যাবেনা



হ্যাঁ, ঠিক এই ভাবে
একটি ট্রে'র মাধ্যমে হস্তান্তর করতে হবে

Safe Injection Practices

- Dedicated clean area for injection preparation
- Disinfect the rubber septum on a medication vial with alcohol before piercing.
- One patient one syringe one needle
- No reuse business

For Multi Dosing (Insulin, Local anaesthetics)

- It is the best way to use a multi-dose vial for a single patient
- Store it with the patient's name & date of opening
- Every time disinfect the rubber septum with alcohol
- Every time use a different needle

When to discard a vial

- Discard a Multi-Dose Vial:
 - If sterility of content is compromised.
 - If the expiry date or time has passed.
 - If it has not been properly stored after opening.
 - Within 24 hours of opening, or after the time recommended by the manufacturer.



When to change the infusion set ?

- Normal IV fluid (No additive): 72 hours interval
- Any additive/TPN (Total parenteral nutrition): 24 hours interval
- Blood transfusion: 12 hours interval
- Site of IV cannula: 72 hours interval

Sterilization and Disinfection of Patient care equipments

-
- **Sterilization:** It is the process by which an article is made free of all microorganisms including spore.
 - **Disinfection:** It is a process which aims to reduce the number of pathogenic microorganisms so that infection does not occur.

Cont.....

- But the spore does not kill in disinfection.
- This is the main difference between Sterilization and Disinfection.
- Examples of disinfection-
 - ✓ Apply spirit to the injection site
 - ✓ Boiling water

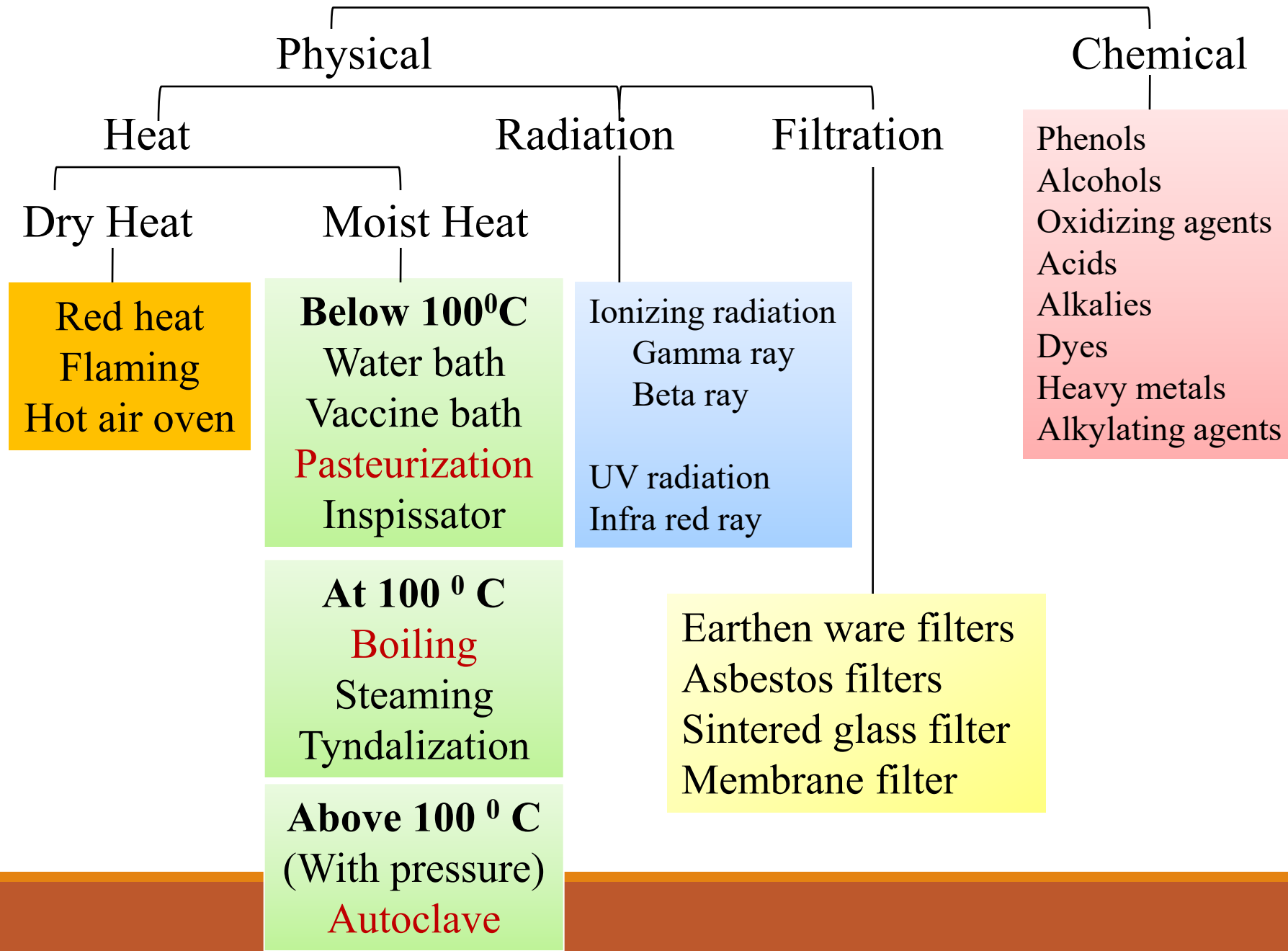
Difference between Disinfectant and Antiseptic

- **Disinfectant:** It is usually a chemical agent which is used to disinfect non living object.
 - Example: **gluteraldehde (Cidex)**
- Most of the disinfectants are irritant and injurious to living surfaces.

Cont.....

- **Antiseptic:** it is an agent which is used to disinfect living tissue. It is usually diluted form of disinfectant.
 - Ethyl alcohol (70%)
 - Chlorhexidine (2.5%)
 - Povidone iodine (5-10%)

Classification of sterilization and disinfection



Cont.....

Hot air oven: Heating instruments in a chamber at 160°C for 1 hour

Example: Swab stick, Glassware, powder, oil



Moist Heat

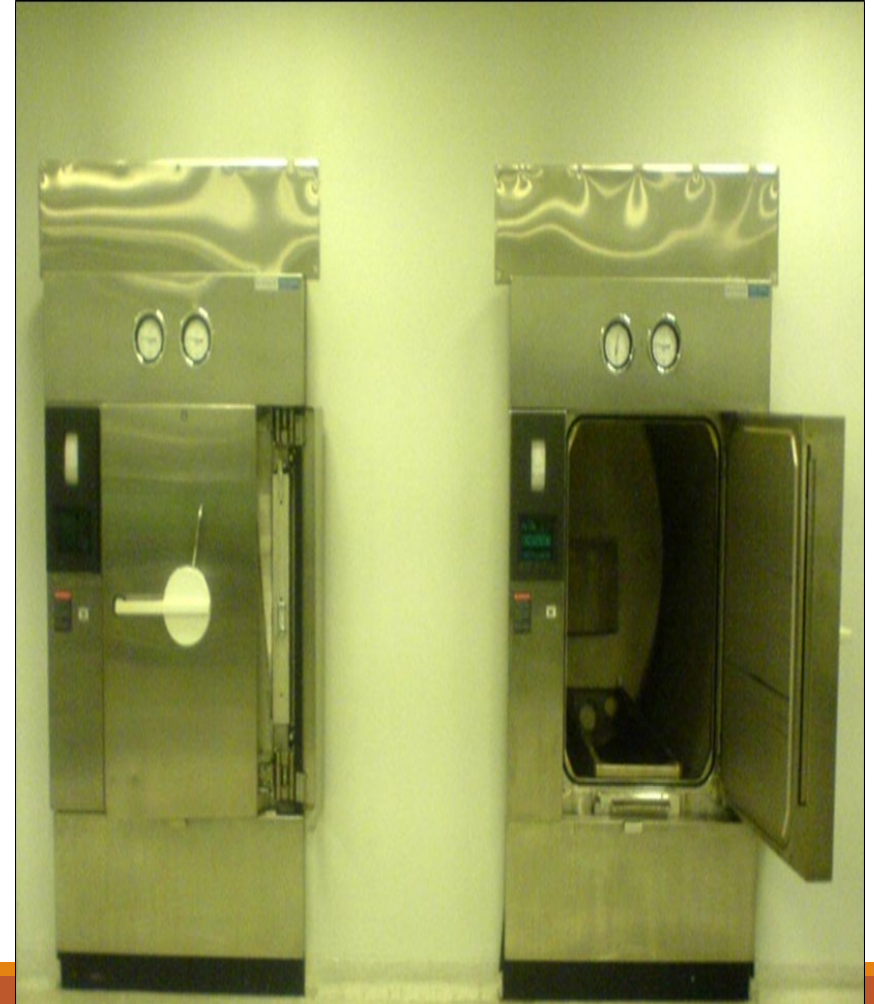
Above 100 °C

Steaming with pressure: autoclave

134°C for 3.5 minutes at pressure of 30psi

Use:

- **Culture media**
- **Bottle with rubber cap.**
- **Blunt surgical instruments, dressing and aprons.**



Chemical methods

Phenol (**carbolic acid**) আগে খুব ব্যবহার হতো

Use of phenol

- Bathrooms, Bed pans, Hospital floor

Cresol are more potent than phenol

- Sold as 2% **Lysol** as germicidal lotion
- বর্তমানে Lysol গৃহস্থালির কাজে খুবই পপুলার

Alcohols

Ethyl alcohol (70%)

- Disinfection of
 - skin, thermometer, hand sanitizer

Isopropyl alcohol (70%)

- More efficient and more toxic

Oxidizing agents

A. Halogens: (Chlorine, Iodine)

Chlorine: water disinfectant

Iodine: Skin disinfectant (10% Povidone iodine)

Sodium hypochlorite (5.25%): Used to disinfect body fluid.

B. Hydrogen Peroxide

Liquid form: used for Disinfection of Medical and surgical devices, Contact lenses

Vapor form: Excellent sterilizer

Alkylating agents

Very powerful

Can kill **spores**

Example

- Glutaraldehyde (Cidex)
- Formaldehyde
- Ethylene oxide (EO)

Formaldehyde

Formalin (40% formaldehyde): To preserve Pathological sample

In gaseous form (**Fumigation**): To decontaminate rooms, fabrics (আজকাল বেশী ব্যবহার হয়না)

Glutaraldehyde

10 times more effective than formaldehyde and **less toxic**.

Sterilization of surgical instruments

হাসপাতালে এটি আজকাল বেশী অনেক ব্যবহার হয়

Cont.....

Ethylene oxide (gaseous form)

- **Used to sterilize heat labile agents**
 - Plastic items, many medical and surgical equipments

Disadvantage

Toxic

Time consuming

Explosive

আজকাল এর ব্যবহার ক্রমশঃ কমে আসছে

There are 3 levels of disinfectants

High level

Intermediate level

Low level



High level disinfectant:

- They can **kill spores**
- For instruments used in **invasive procedures**

Example:

Gluteraldehyde (Cidex)

Ortho-phthalaldehyde (OPA)

Intermediate level disinfectant: Used in

laryngoscope

vaginal spatula

Example:

Ethyl alcohol

Isopropyl alcohol

(cannot kill spores)

Low level disinfectant:

For **instruments** used in Non critical procedures

Contact with skin

Household cleaning

Example:

BP cuff

ECG electrodes

Bedside tables

Floor, furniture

Example: Detergent, Soap

Decontamination/Cleaning

Special care for

blood clots
Tissue debris
Organic subs



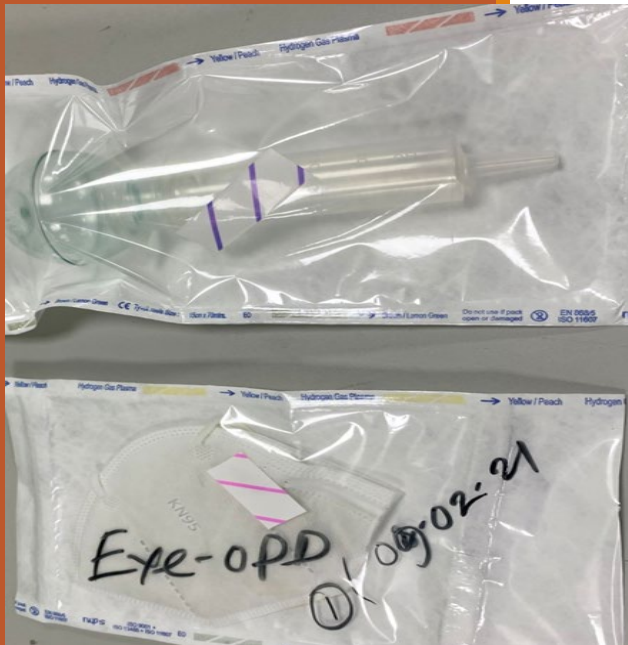
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Inspection Sorting

Look for

- functionality
- defects
- breakage





Trolley must be covered when bringing instrument from Central Sterile Services Department (CSSD)

Aseptic technique

- **Aseptic** = without microorganisms
- Two types of asepsis
 - Medical asepsis**
 - Surgical asepsis**

Medical asepsis

- Also called **clean asepsis**
- technique or procedure which reduces the number of micro organisms and thus prevents the spread of disease.
- Example: Urinary catheter insertion

Surgical asepsis

- Means **sterile asepsis**
- **Sterile technique that completely kill and eliminate microorganisms.**
- Example: incision before surgery
- Surgical asepsis (Sterilization) **is stronger** than Medical asepsis (Disinfection)

Pre-operative practices and procedures:

Patient

- Patients own **normal flora** can enter his/her body
- It is better to bathe the patient before operation
- The specific area should be disinfected
- A **sterile field** should be created by wearing a sterile drape

Keep The OT Environment Sterile

- Restrict traffic
- Keep doors closed
- Maintain positive-pressure airflow
- Do not allow persons without PPE
- Keep surfaces disinfected

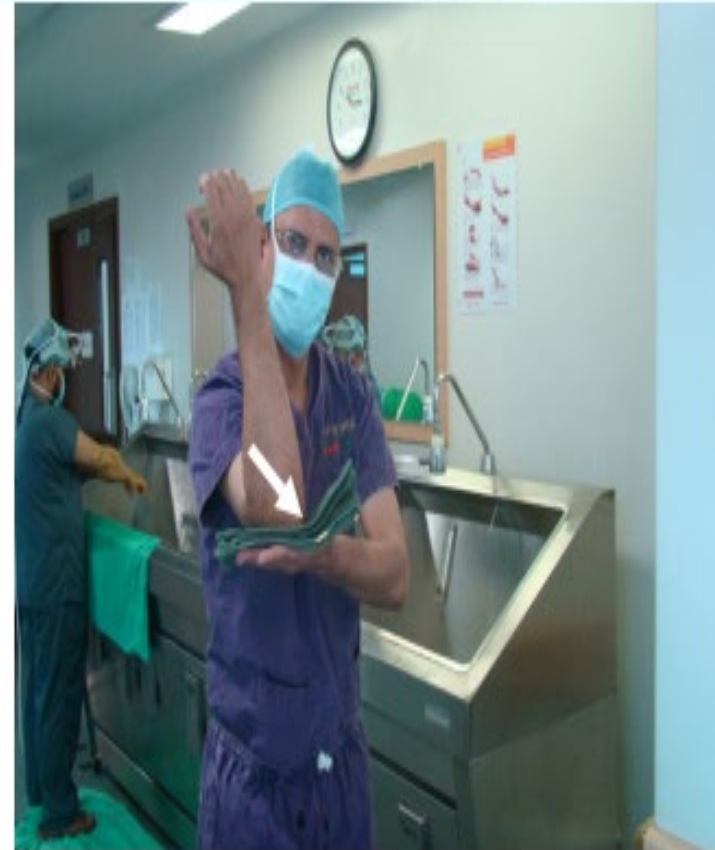
Pre-operative practices

- Remove jewelry (অলংকার খুলে রাখুন)
- Wash hands and forearms (সাবান দিয়ে নিয়ম অনুযায়ী হাত ধুয়ে ফেলুন (২ থেকে ৩ মিনিট)
- Thorough drying (এর পর ভালভাবে হাত শুখিয়ে নিন)

প্রথমে একটি হাত মুছে নিন



যখনই কুনুই স্পর্শ করলেন টাওয়ারের এই
অংশটি
unsterile হয়ে গেল



এখন খুব সাবধানে ভাঁজ খুলে
টাওয়েলটি উল্টে নিন



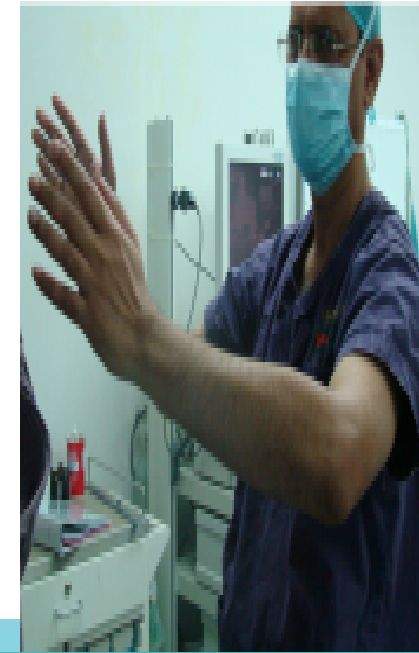
এবার অন্য হাতটি মুছে নিন



- Wash নেবার সময় হাত কুনুইয়ের নীচে থাকবে

কিন্তু

- Wash নেবার পরে হাত কুনুইয়ের উপরে থাকবে





- যারা জীবাণু মুক্ত অবস্থায় আছেন শুধুমাত্র তারাই স্টেরাইল ফিল্ডটি স্পর্শ করতে পারবেন
- হাত সব সময় স্টেরাইল ফিল্ডে থাকবে
- কেবল মাত্র জীবাণু মুক্ত বস্তুই স্টেরাইল ফিল্ডে থাকতে পারবে

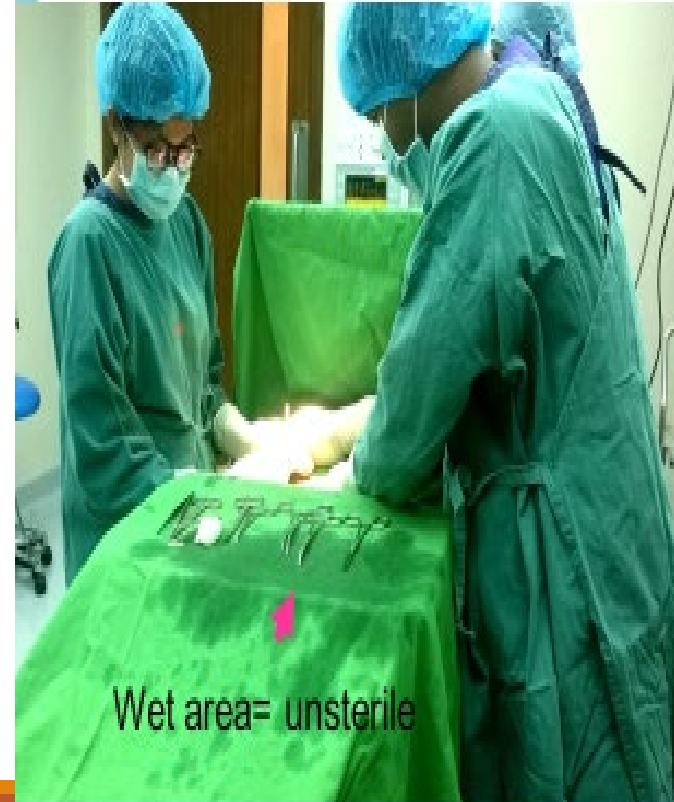


Wrong practice: সার্জনের পিছনের অংশ আনস্টেরাইল।

সুতরাং স্টেরাইল ফিল্ডটি আর স্টেরাইল নেই।



স্টেরাইল ফিল্ডের কোন অংশ ভেজা অবস্থায় থাকলে এটিকে আনস্টেরাইল ধরা হয়



Wet area= unsterile





**You cannot pass any unsterile item
over the sterile field**

১। সার্জনের পিছন দিক ঘেঁসে instrument রাখা হয়েছে

২। instrument এর টেবিলের উচ্চতা স্টেরাইল ফিল্ড থেকে নীচে

Type of Wound	Expected rate of infections
Clean	2%
Clean-contaminated	4-10%
Contaminated	10%
Dirty	25%
Emergency operation	2 to 4 times risk then elective operations

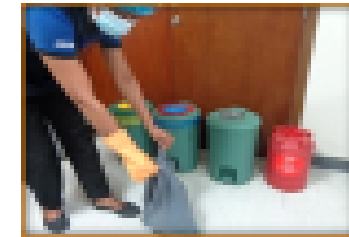
Waste management

4 Steps :

Sorting (বাছাই)



Handling (স্থানান্তর)



Interim storage (খন্ডকালীন ব্যবস্থা)

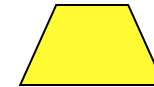


Final disposal (সমাপ্তি)



Use of color coded bins

- **Red:** Sharps
- **Yellow:** for contaminated or potentially contaminated items
- **Blue:** for liquids (including body fluids)
- **Green:** for plastics and glasses (recyclable)
- **Black:** for household/ non-clinical items



Handling of waste



Waste transfer

At first, tie the opening of the bag



Handling of waste



- Use different elevator /staircase for waste transfer
- Do not touch the button of the elevator with gloves on

Interim storage

- Select specific location
- Refrigerate perishables
- Public access is prohibited
- Animals can not enter



Final disposal

- May have its own system
- Outsourcing can also be done

Example:

- **PRISM**, an NGO, funded by Canadian govt.

- There should be an account of when & where what amount of waste is going through the log book



Transmission Based Precautions

Transmission-based precautions are 3 types:

- Contact
- Droplet
- Airborne

Common organisms where contact precaution is applicable

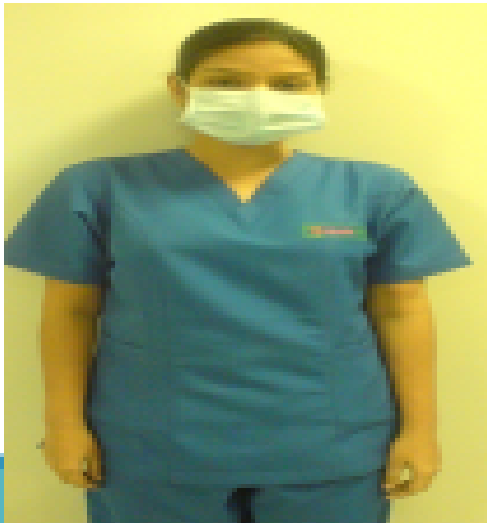
- MRSA (Methicillin Resistant Staphylococcus aureus)
- VRE (Vancomycin Resistant Enterococcus)
- Hepatitis A and E
- Salmonella
- Shigella
- Cholera
- Rotavirus

Indications for droplet precautions

- H. influenzae
- N. meningitidis
- C. diphtheriae
- B. pertussis
- Streptococcal pharyngitis
- Influenza, Mumps, rubella, Adenovirus, Parvovirus B19

Indications for air borne precautions

- TB
- Measles
- Chicken pox
- Bird flu
- Swine flu
- SARS
- MERS
- COVID 19

Contact precaution	Droplet precaution	Air borne precaution
Isolation + Gown & Gloves	Isolation + Surgical mask	Isolation + Respirator/N95 mask + Negative pressure ventilation
		

Key Messages

- Hand washing is the single procedure for preventing infection
- In which cases sterilization and which cases disinfection is required.
- Sterilization/Disinfection will not happen if we don't give enough time.
- Trolley must be covered when bringing instrument from Central Sterile Services Department (CSSD)

Referances

- Apurba S Sastry, Sandhya Bhat. Hospital Infection Control. Essentials of Medical Microbiology, 3rd ed. pp-603-634.
- Nizam Damini. Manual of Infection Prevention and Control, 4th ed .
- World Health Organization. Infection prevention and control.
<https://www.who.int/teams/integrated-health-services/infection-prevention-control>.
- Healthcare-Associated Infections (HAIs) | HAI | CDC
- Preventing Healthcare-associated Infections | HAI | CDC
- Types of Healthcare-associated Infections | HAI | CDC

An illustration of two hands, drawn with simple grey outlines, cupping a small globe of the Earth. The globe shows green continents and blue oceans. The hands are positioned on either side of the globe, with fingers pointing downwards. The entire graphic is centered on a white background.

Thank you.

**Your dedication to
infection prevention
helps save lives.**