

STERILIZATION

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PROGRAM OUTCOMES (PO)

- PO1: Apply Ayurvedic and modern concepts of sterilisation in clinical practice.
- PO2: Demonstrate safe handling of instruments and maintenance of asepsis.
- PO3: Integrate traditional Ayurvedic methods (Dhupana, Rakshoghna karma) with modern sterilisation techniques.
- PO4: Contribute to infection control and patient safety in healthcare settings.

COURSE OUTCOMES (CO)

- CO1: Explain the principles and methods of sterilisation (heat, chemical, radiation, Ayurvedic).
- CO2: Differentiate between sterilisation, disinfection, and antisepsis.
- CO3: Perform autoclaving, chemical sterilisation, and fumigation procedures.
- CO4: Identify appropriate sterilisation methods for sharp instruments and delicate materials.
- CO5: Apply Ayurvedic sterilisation practices (Dhupana, Rakshoghna karma) in wound management

LEARNING OBJECTIVES

- Understand the definition and importance of sterilisation.
- Recall pioneers and history of antisepsis (Lister, Pasteur).
- Classify sterilisation methods (heat, chemical, radiation, Ayurvedic).
- Demonstrate practical sterilisation of instruments and materials.
- Apply sterilisation knowledge to prevent hospital-acquired infections.

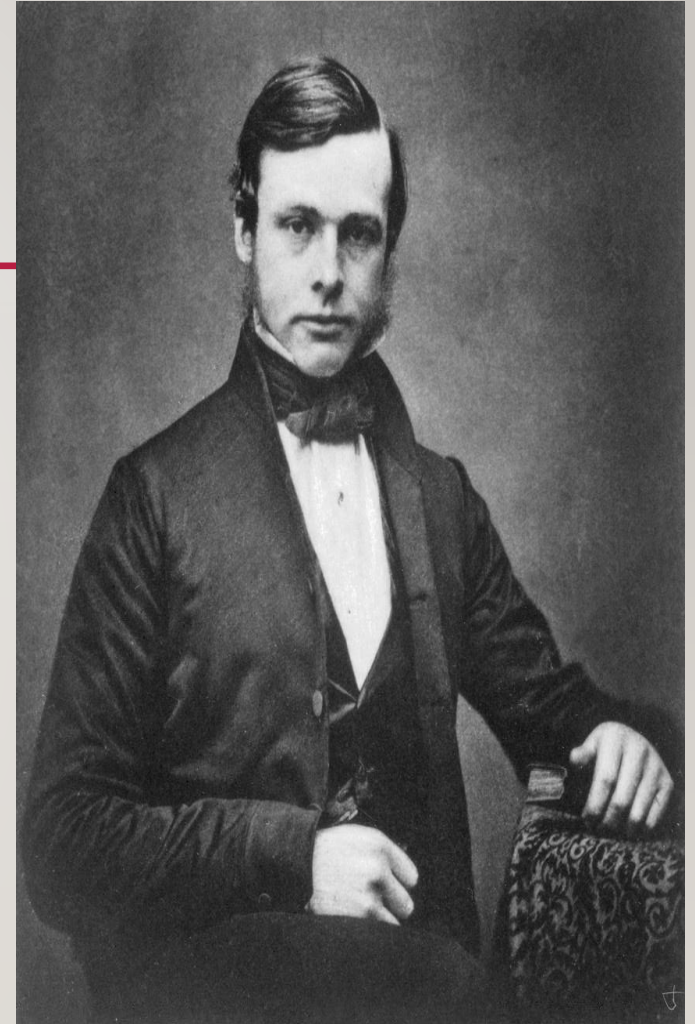
DEFINITION

“Process of freeing an article, a surface or a medium of all microorganisms, both in vegetative and in spore states, by removing or killing them.”

CONCEPT OF STERILIZATION IN AYURVEDA

- रक्षोघ्न कर्म एवं धूपन कर्म (सु.सू. 5)
- धूपन द्रव्य- गुग्गुलु, अगर, सर्जरस, वच,
- व्रणागार (सु.सू. 19)
वातातप वर्जिते, निवाते
- व्रणधूपन (सु.सू. 19) BD for 10 days
सर्षप, निम्ब, घृत, लवण
- व्रणधूपन (सु.चि. 1)
- उदरान्मेदसो वर्तिर्निर्गता यस्य देहिनः ॥
कषायभस्ममृत्कीर्णा बद्ध्वा सूत्रेण सूत्रवित् ॥
अग्नितप्तेन शस्त्रेण छिन्द्यान्मधुसमायुतम् (सु.चि. 2)

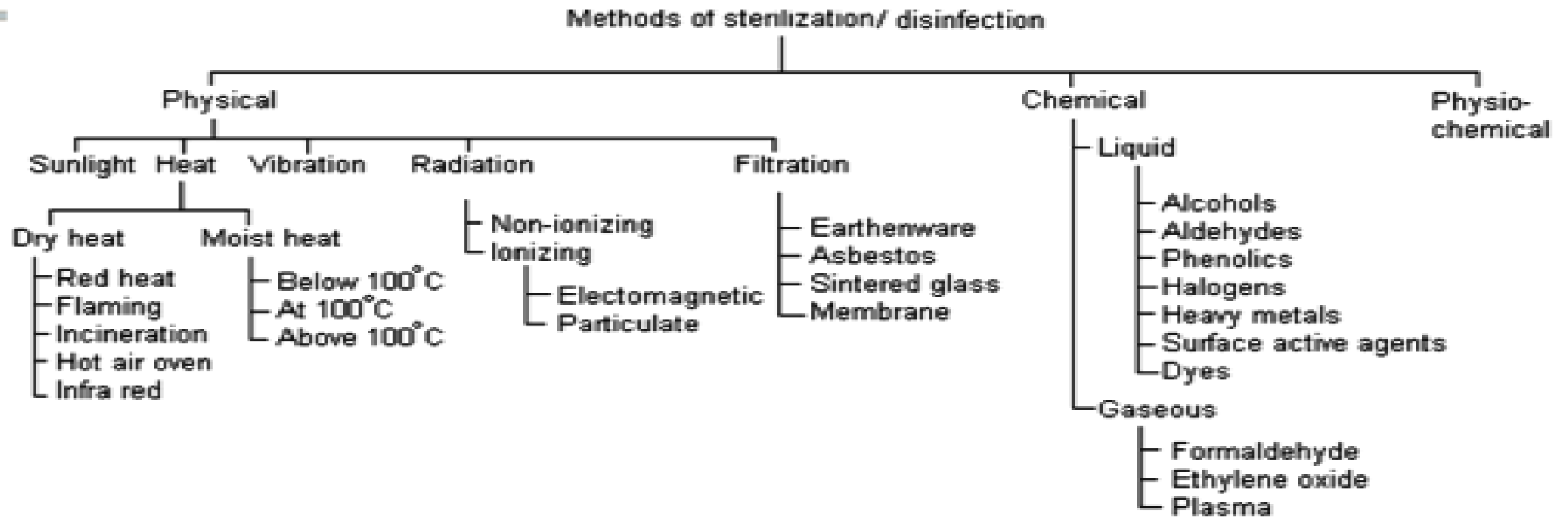
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- Joseph Lister- Pioneer of antiseptic surgery
 - 1867- Antiseptic Principles of the Practice of Surgery
 - Used Phenol/Carbolic acid to kill germs
 - Inspired by Louis Pasteur's Germ Theory of Disease



TERMINOLOGY

- Septicemia- state of microbial invasion into bloodstream
- Sepsis- extreme inflammatory response of body to an infection
- Asepsis- practice to eliminate infection causing organisms from entering the environment of the patients
- Antisepsis- destroy microorganisms on living tissue
- Disinfection- destroy microorganisms except bacterial spores on non-living objects
- Antibiotics- destroy microorganisms within the body
- Sanitization- reduces the number of microorganisms to a safe level

METHODS OF STERILIZATION



STERILIZATION BY HEAT

- Dry Heat
 - Red heat
 - Flaming
 - Hot Air Oven (160°C for 1 hour)- glassware

Moist Heat

- Heating below 100°C (Pasteurization 72° for 30 seconds)
- Boiling (100°C for 30 minutes)
- Steaming (100°C steam under normal atmospheric pressure)
- Autoclaving (15-20 Psi pressure, 121°C temperature for 20-45 minutes)

STERILIZATION BY MOIST HEAT/STEAM

- most widely used method of sterilization
- nontoxic, inexpensive, penetrating rapidly, microbicidal and sporicidal
- When water is boiled at increase pressure inside a closed vessel, the boiling point of water increases and so is the temperature of the steam produced. To bring one liter of water to the boiling point (100°C) requires 80kcal of heat energy. Converting that liter of water to steam requires 540kcal. This means that steam at 100°C contains seven times as much energy as water at 100°C . It's that energy that makes steam so much more efficient at destroying microorganisms.
- When steam comes in contact with a cooler surface, it condenses into water and give up its latent heat to that surface leading to sterilization.

STERILIZATION BY STEAM : MODE OF ACTION

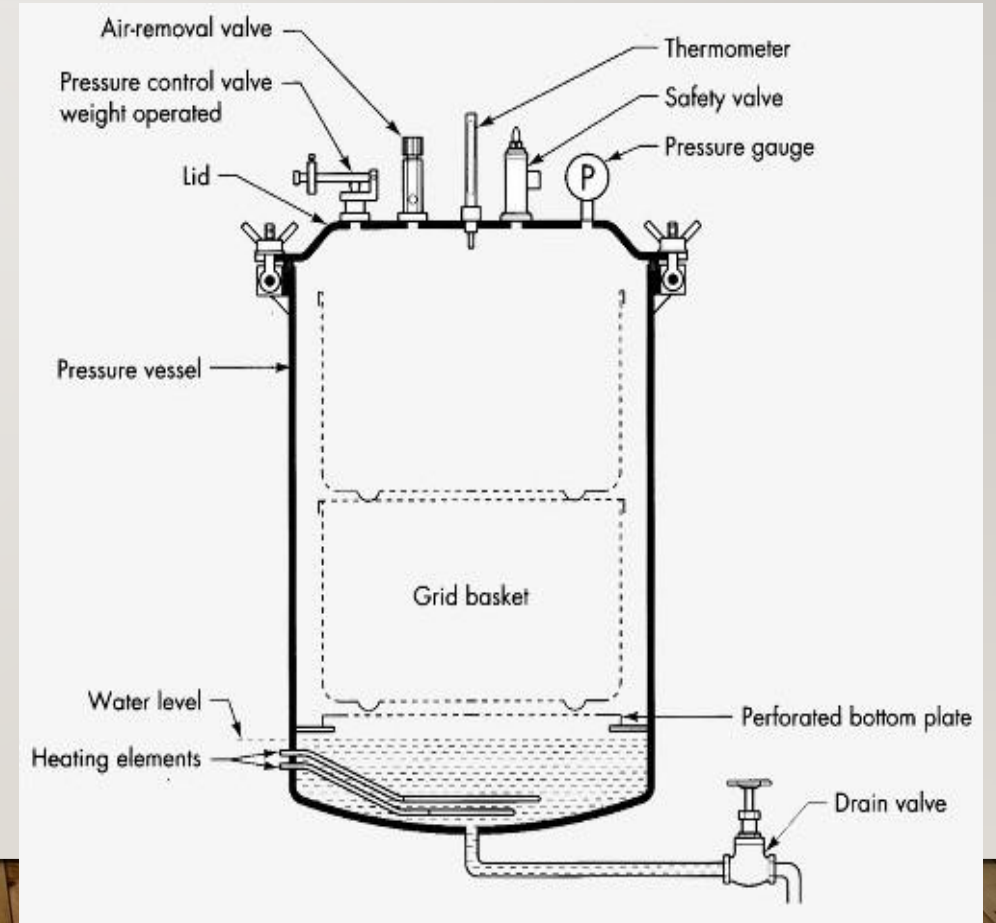
- Denaturation and Coagulation of the proteins of pathogens
- Breakage of DNA strands of microorganisms
- Loss of functional integrity of cell membrane of microorganisms.

AUTOCLAVING

- Sterilization by saturated steam produced under desired pressure.
- Pressure is directly proportional to temperature
- Pressure rises causes to temperature rise on which water boils
- 15 pounds per square inch (Psi) = 121 degree
- Pressure higher than atmospheric pressure needs a temperature more than 100 degree to boil water

AUTOCLAVE /STEAM STERILIZER

- 1879 by Charles Chamberland



TYPES OF AUTOCLAVE

On the basis of number of drums in chamber	On the basis of placement of drums in chamber	On the basis of shape of chamber	On the basis of loading
Single drum Double drum Multi drum	Horizontal Vertical	Cylindrical Rectangular	Top-loading Front-loading
Multi- drum best	Vertical autoclave provide different sterilization level for different loads	Cylindrical best Less costly Light weight	Front loading easy to handle but require space to operate

AUTOCLAVING AND DIFFERENT LOADS

Name of Article	Metal instruments (unwrapped), Rubber Catheter, gloves, Syringes	Metal instruments (wrapped), Threads, Metal wires	Linen, towel, gown, dressing, gauze, pads, cotton
Time required for complete sterilization	20 min	30 min	45 min
Place in Autoclave for complete sterilization	Lower part of Chamber	Middle Part of Chamber	Upper Part of Chamber

AUTOCLAVE : STERILIZATION PHASE

3 phases

- Purge phase- replacement of air by vacuum or steam
- Exposure phase- exposure of steam to tissues
- Exhaust phase-removal of steam

STERILIZATION OF SHARP INSTRUMENTS

- Autoclaving and Boiling should not be used as method of sterilization for sharp instruments due to fear of blunting, rusting and electrochemical corrosion of sharp edges.
- Phenol/Carbolic Acid
- Lysol
- Formalin chamber
- Cidex/glutaraldehyde
- Hot air oven

STERILIZATION BY CHEMICAL METHODS

- Phenol/Carbolic acid- Sharp instruments sterilization, Sclerotherapy
- Alcohol- spirit
- Formalin-30% formaldehyde+ 10% methane, biopsy, fumigation
- Lysol- concentrated cresol solution
- Eusol- Edinberg University Solution
- KMnO_4
- Ozone
- Iodine
- Betadine/Povidine-Iodine
- Paracetic acid- for flexible endoscopes

WEAK IODINE SOLUTION

- Iodine tincture 5% + Alcohol 65%
- Used for preoperative painting of skin
- It need to be wiped out with spirit after 2 minutes of painting due to its irritable properties to skin and mucosa.

BETADINE

- 5-10% topical solution
- Povidone-Iodine/Iodopovidone
- Povidone or PolyVinyl Pyrrolidone or PVP combined with iodine to eliminate the undesirable toxic effects of iodine.
- Antiseptic used for skin disinfection before and after surgery and dressing of minor wounds
- Frequent use is not recommended due to its irritability

SURGICAL SPIRIT/RUBBING ALCOHOL

- Ethyl alcohol/Ethanol
- Iso-propyl alcohol/Propano-70-99% v/V
- Disinfection before IM/IV
- Cleaning of surroundings of wound/ulcer
- Iodine removal after preoperative skin preparation
- Skin preparation along with other disinfectants

HYDROGEN PEROXIDE

- It is a cleansing agent not an antiseptic.
- Released nascent oxygen
- Destroys anaerobic microorganisms
- Heat production
- Hemostasis

EUSOL & LYSOL

EUSOL

- Edinberg University Solution
- 12.5 gm Bleaching powder
- 12.5 gm Boric acid
- 1 litre Water
- Releases nascent chlorine
- Used for slough removal

LYSOL

- Concentrated Cresol Solution
- Used for the sterilization of sharp instruments

STERILIZATION BY GASES

- Ethylene oxide- heat and moisture sensitive objects
 - plastic items
 - electric equipments
- Ozone
- Formalin 40% formaldehyde

STERILIZATION BY RADIATIONS

- Non- Ionizing radiation
 - Infrared Rays
 - Ultra Violet Rays
 - Microwaves
- Ionizing Radiation
 - Gamma rays- large batches of similar products eg. Syringes, IV canula, catheters, industrial packaging
 - Cosmic rays

SURGICAL SCRUB

Figure 1. Six steps to handwashing

1



Rub palm to palm

2



Rub back of left hand over right palm
and vice versa

3



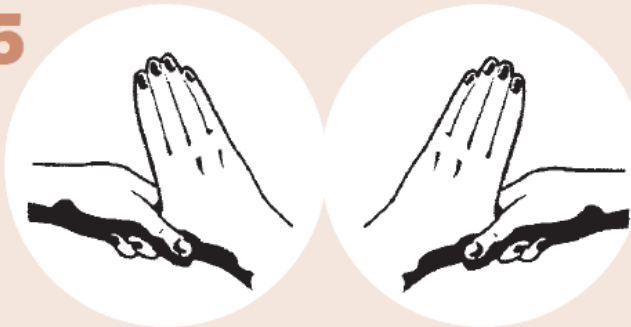
Rub palm to palm with fingers
interlaced

4



Rub backs of fingers on opposing palms
with fingers interlocked

5



Rub around right thumb with left palm
and vice versa

6



Rub palm of left hand with fingers
of right hand and vice versa

GOWNING



1. DRY HANDS



2. PICK UP GOWN



3. LET GOWN UNFOLD



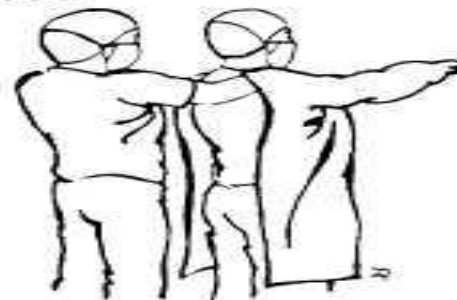
4. OPEN TO LOCATE
SLEEVE / ARM HOLES



5. SLIP ARMS INTO SLEEVES



6. HOLD ARMS OUT AND SLIGHTLY UP



7. CIRCULATOR PULLS GOWN ON

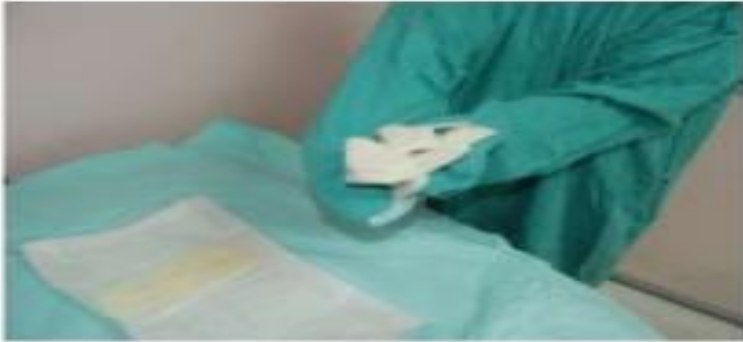
GLOVING

Method for Open Gloving



Open gloving. **A**, The wrapper is opened without touching the inner surface. The 1st inner glove cuff is grasped without touching the sterile surface and slid over the 1st hand. The 1st cuff remains folded. **B**, The 1st gloved hand is slid into the 2nd cuff on the sterile surface. **C**, The 2nd glove is applied all the way up and over the knitted cuff. **D**, The 1st cuff is now pulled over the knitted cuff.

Closed gloving method



DEGLOVING

“Beak Method” Glove Removal Steps		
		
STEP 1: Using one gloved hand, pinch and pull the base of the other gloved hand.	STEP 2: Use the middle finger to scoop the cuff of the glove.	STEP 3: Pull the glove inside out over all the fingers and thumb to form a “beak.”
		
STEP 4: With the beaked hand, pinch the opposite glove at the base and pull the cuff.	STEP 5: Roll the glove inside out and off the hand.	STEP 6: With the ungloved hand, use the index finger to pull the beaked glove off at the base of the beak and dispose into the appropriate waste container.
		Always wash your hands after glove removal.

- Q1. The pioneer of antiseptic surgery is:

- a) Robert Koch
- b) Louis Pasteur
- c) Joseph Lister 
- d) Charles Chamberland

- Q2. Autoclaving is usually performed at:

- a) 100°C for 30 min
- b) 121°C at 15 psi 
- c) 160°C for 1 hour
- d) 72°C for 30 sec

Q3. Dhupana karma is mentioned in which Ayurvedic text?

- a) Sushruta Samhita ☒
- b) Charaka Samhita
- c) Ashtanga Hridaya
- d) Bhava Prakash

Q4. Which chemical is commonly used for sterilisation of sharp instruments?

- a) Autoclave
- b) Alcohol
- c) Lysol ☒
- d) Hydrogen peroxide

Q5. Betadine contains:

- a) Phenol
- b) Ethanol
- c) Povidone-Iodine ☒
- d) Chlorhexidine

Q6. Radiation used for sterilising disposable syringes and catheters:

- a) UV rays
- b) Infrared rays
- c) Gamma rays ☒
- d) Microwaves

