

ASEPSIS AND ANTISEPSIS

- Asepsis is the state of being free from disease-causing contaminants (such as bacteria, viruses, fungi, and parasites), the measure refers to those practices used to prevent infection.



Asepsis

Asepsis is defined as the absence of infectious organisms.



Aseptic

(Greek a – negation + septicas – purulent) – is a complex of prophylactic / preventive measures, which prevent the contamination of wounds, tissues, organs with pathogenic bacteria, from exogenous sources, during surgical interventions and other medical manipulations.



Base principals of asepsis – isolation and sterilization.



Antisepsis:

Antiseptic surgery means killing the bacteria, which are already present in the wound by the use of chemicals known as antiseptics. Antisepsis – methods to combat bacterial infection in the wound, elimination of all infectious micro-organisms during procedures in surgical department.



History

In **ancient times**, demons and evil spirits were thought to be the causes of pestilence and infections. **Hippocrates (460-377 BC)**, the great healer of his time irrigated wounds with wine or boiled water foreshadowing asepsis. **Galen (130-200 A.D.)**, a Greek that practiced medicine in Rome and was the most distinguished physician after Hippocrates boiled his surgical instruments used in the caring of wounded gladiators.



In the mid-nineteenth century Oliver Wendell Holmes and Ignaz Semmelweis observed high mortality rates in women hospitalized with puerperal fever.

Semmelweis noted it was especially high in women treated by students who had come straight from the mortuary and postulated that infection was being transmitted directly.



1847 - THE HUNGARIAN OBSTETRICIAN-GYNECOLOGIST **SEMMELWEIS IDENTIFIES**

that the hands of a surgeon were the source of puerperal fever among women in childbirth.

He was the first doctor who used chloral water for treatment of the surgeon's hands, birth tracts, instruments and materials. Semmelweis showed that washing the hands prior to delivery reduced puerperal fever.

He managed to decrease the birth sepsis in 10 times. The instigation of a strict handwashing regime resulted in a decrease in mortality from 11.4% in 1846 to 1.3% in 1848.



Antiseptic surgery was largely pioneered by Joseph Lister, he used phenol (known at the time as carbolic acid) as a disinfectant. He would sterilize the operating theatre and surgical tools with phenol, and even soak bandages in the substance before dressing wounds. Although this was effective, he failed to recognise the importance of asepsis at the time.



Lister's carbolic spray and wound preparation reduced infection rates from 45% to 15%.

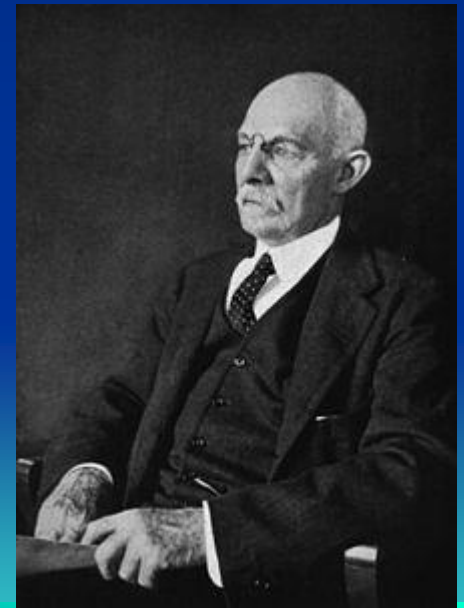
1865 - After the suggestion by Louis Pasteur, **Lister** introduces hand and wound asepsis with the use of carbolic acid as an antiseptic and reduced surgical infections rates.



1880 - Ernst von Bergmann
invents the autoclave, a device
used for the practice of the
sterilization of surgical
instruments.



In 1889 Halstead at Johns Hopkins Hospital noted that his theatre nurse was allergic to the corrosive hand preparation and asked the Goodyear Rubber Company to **manufacture gloves for her to wear**. Soon after this the use of gloves and gowns became standard practice; first to protect the patient from the surgeon (in aseptic ritual), but **later to protect the surgeon from risk of blood-borne viruses from the patient.**



The principles of antiseptics and asepsis

are used to decrease the rate of SSIs.

The source of infection is either **exogenous** (transmitted from another source) or **endogenous** (caused by the person's own microbial flora).



Endogenous infection

an infection caused by an infectious agent that is already present in the body, but has previously been inapparent or dormant.

Endogenous flora can be classified as **transient** (isolated following exposure to a new microbial environment) or **resident** (isolated consistently from the person).



Exogenous infection

caused by an infectious agent that is
situation around, outside the human body
from air

from infected drops

contact infection

implant infection.



Possible routes for entry of organisms into operating wound

Pre-operatively:

- a) By nasal carriage- about 14.9% of patients harbour staph. Pyogenes in their anterior nares. These patients act as carriers.
- b) From the ward-either by carrier nurses, carrier patients or cross infection from other surgical wounds, infected linens, bed covers, blankets, etc.



During operation:

- a) From improperly prepared skin, which may harbour organisms in the ducts of sweat glands, sebaceous glands and in the sides of hair follicles.
- b) From operation theatre itself- it would appear to be the general agreement that modern operation theatre provides a reasonably safe environment for routine general surgery, yet lower standard operation theatre may provide organisms to infect the wound during operations.
- c) From surgical gloves- danger to leak and tears in the gloves are about 30%, in this context hexachlorophene detergent cream is an effective agent for preoperative scrubbing.
- d) From the masks- there should be an impervious insert within the mask, which will prevent direct contamination of wound with salivary droplets or mucus expelled by inadvertent sneezing.
- e) From drainage of the wound- the longer the drainage is maintained, the greater is the risk of infection.
- f) From foreign bodies, suture material, tissue trauma, devitalised tissue, haematoma etc.



Post-operatively:

wound may get infected if the dressings are not sterilised.



Factors contributing to asepsis in theatre can be broadly considered under the following headings:

- _ prevention on the infection in the surgical ward
 - _ preparation of the patient
 - _ preparation of the surgical instruments
 - _ preparation of the surgeon
 - _ preparation of the operating theatre
 - _ antibiotic prophylaxis
 - _ surgical technique.



preparation of the patient

The patient's own bacterial flora is the principle source of infection in surgical wounds. The preparation of the patient begins with the preoperative assessment. **Any focal source of infection should be treated prior to surgery** and swabs taken for methicillin-resistant *Staphylococcus aureus*

The best time to perform preoperative shaving, **is immediately prior to the surgeon scrubbing** and should be done by a suitable, trained person to avoid skin abrasions.

The patient should be transferred to the theatre wearing a clean gown in a clean bed or trolley.



The preparation of the operating field

For the treatment of the operating field we use iodonate, iodopiron, chlorhexidin before its usage, dissolving the initial solution in 4,5-5 times boiled or sterilized water.

We use the other antiseptics for the treatment of the operating field 1% solution of degmycide, 1% solution of roccal or catamine A-B, 2,4 % solution of pervomur.

For the disinfections of the mucous membrane we use 1 % solution of diamond green, 3 % solution of hydrogen peroxide, 1 % solution of iodonate or iodopiron, 0,5 % spirits solution of hibitan

Reusable or disposable surgical drapes are used to isolate the prepared operative site. Only the area of the drape above the table can be considered sterile.



Preparation of the Surgeon



PrEye protection
Anti-fog goggles
Wrap around spectacles
Face shields
Foot Wear
Clean comfortable
Anti-slip Anti-static
Ankle length boots

Disinfections of surgeon's hands

- Disinfections of hands are a good removal of microorganisms from the hands. **The principal of surgical treatment: care of hands, care of nails, the mechanical cleaning is with soap and a brush during 2-5 min, then disinfections.** A disinfectant must be:
 - exterminate the micro flora quickly;
 - exterminate microbes in the juice of gloves;
 - possess a cumulative effect - hands must be free from microorganisms even in the intervals of disinfections;
 - not irritate the skin.



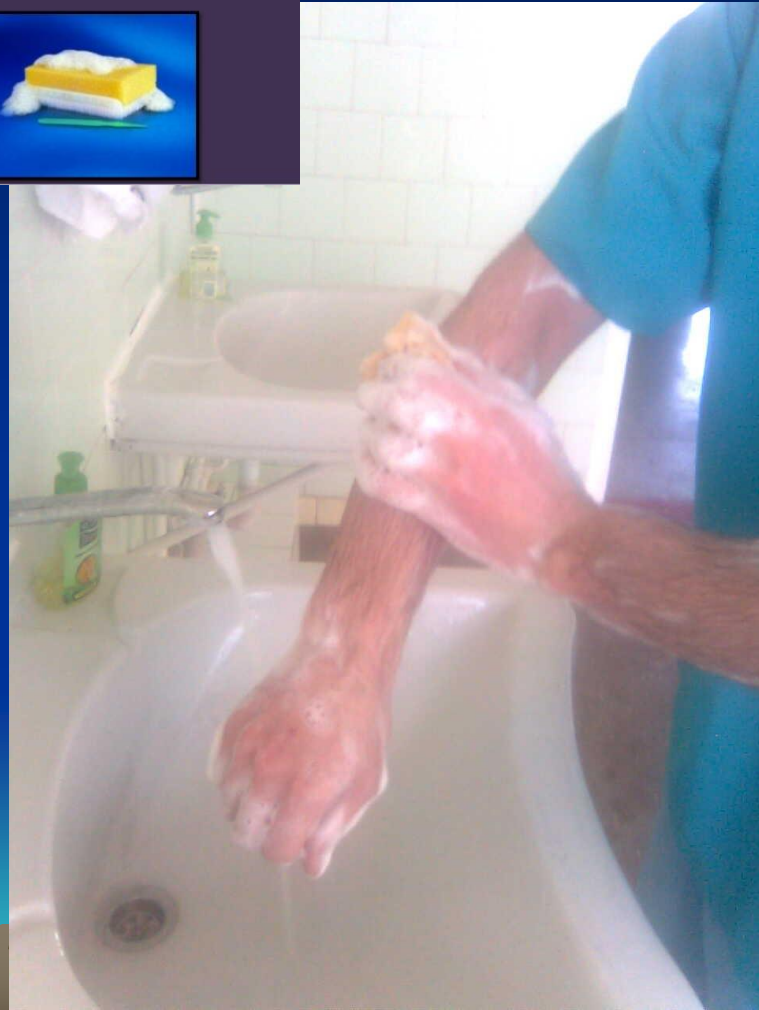
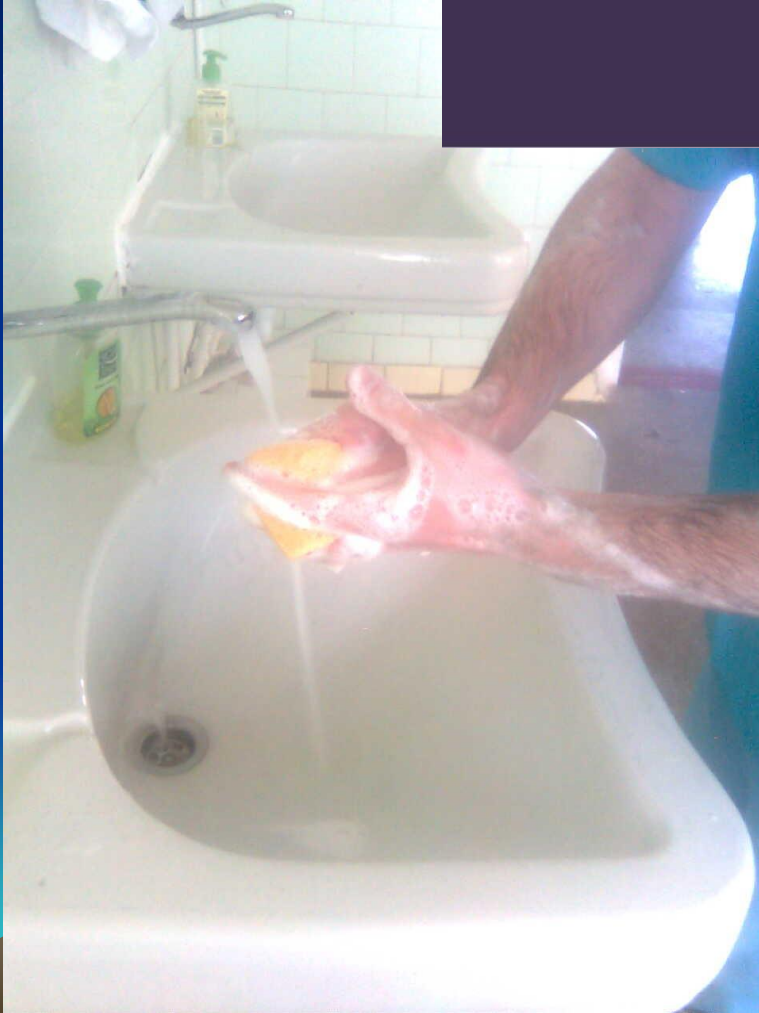
Preparation Before Surgical Scrub

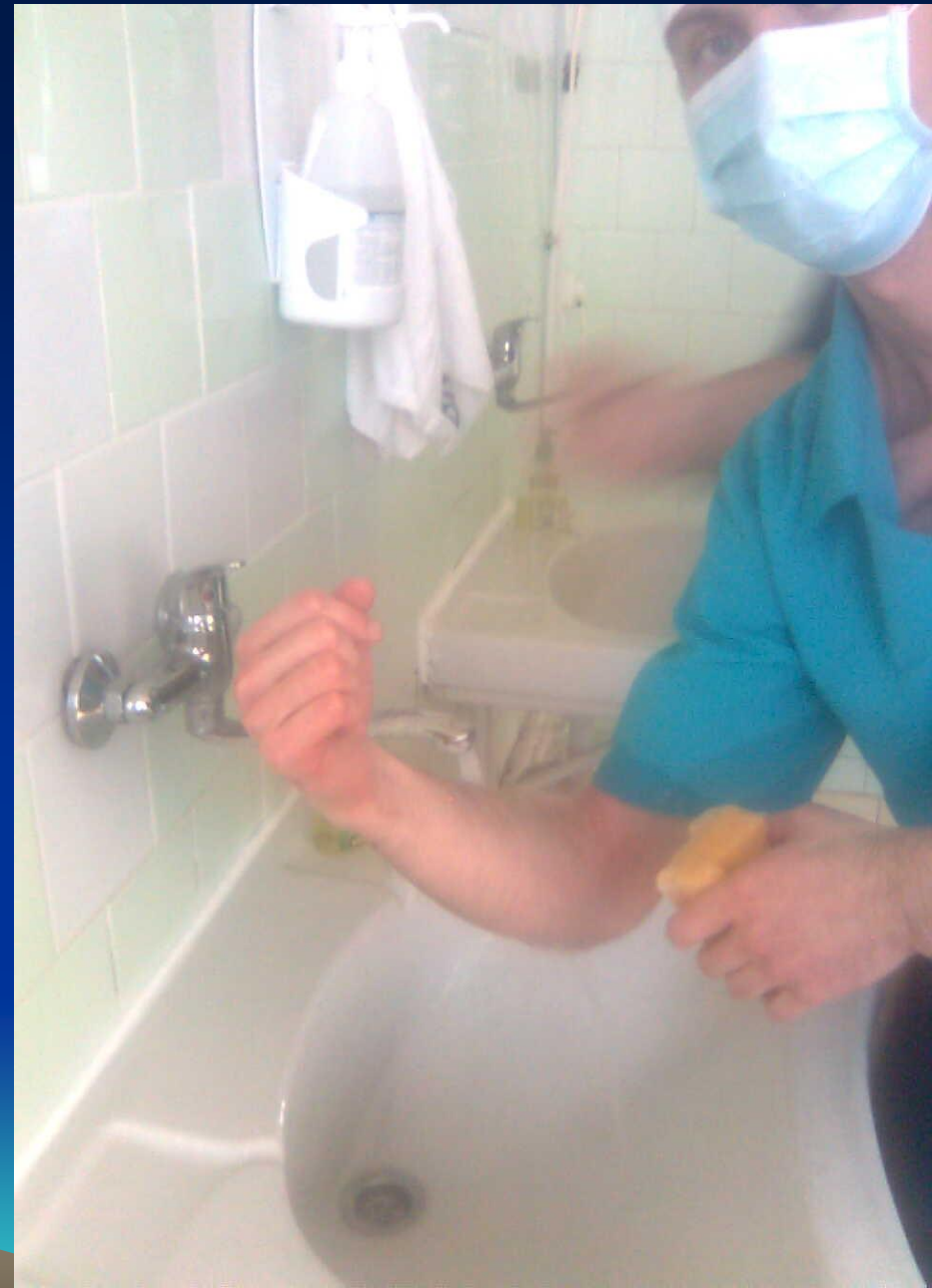
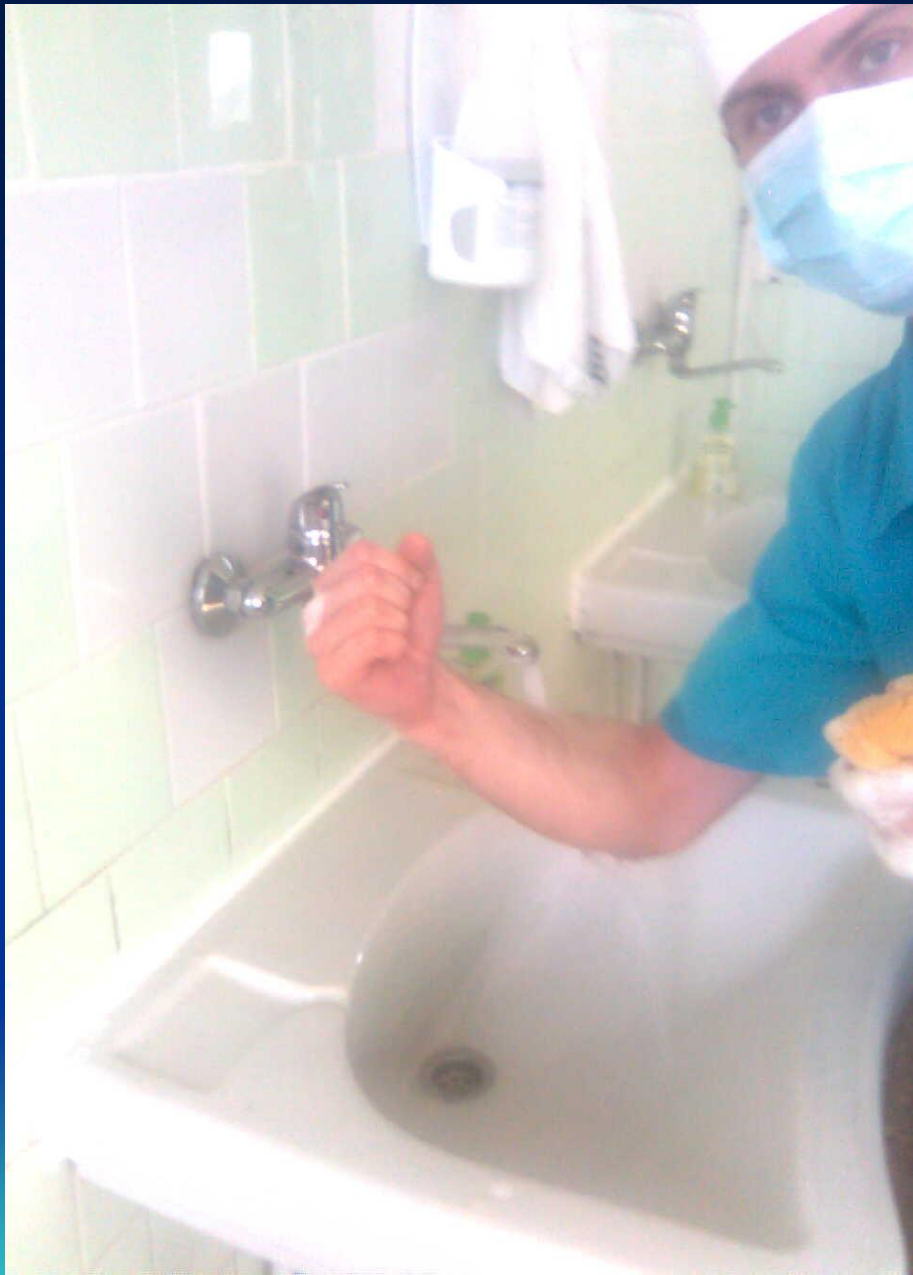
- Removal of finger rings/jewelry, nail polish and artificial nails
 - Finger rings and jewelry can harbor microorganism and dead skin
 - Dark nail polish obscures the subungual space and likelihood of careful cleansing is reduced
 - Artificial nail ↑ the microbial load on hands



The Methodology of the Scrub

- The time method:
 - All surgical scrubs are 3-5 minutes in length
 - All are performed using a surgical scrub brush and an antimicrobial soap solution







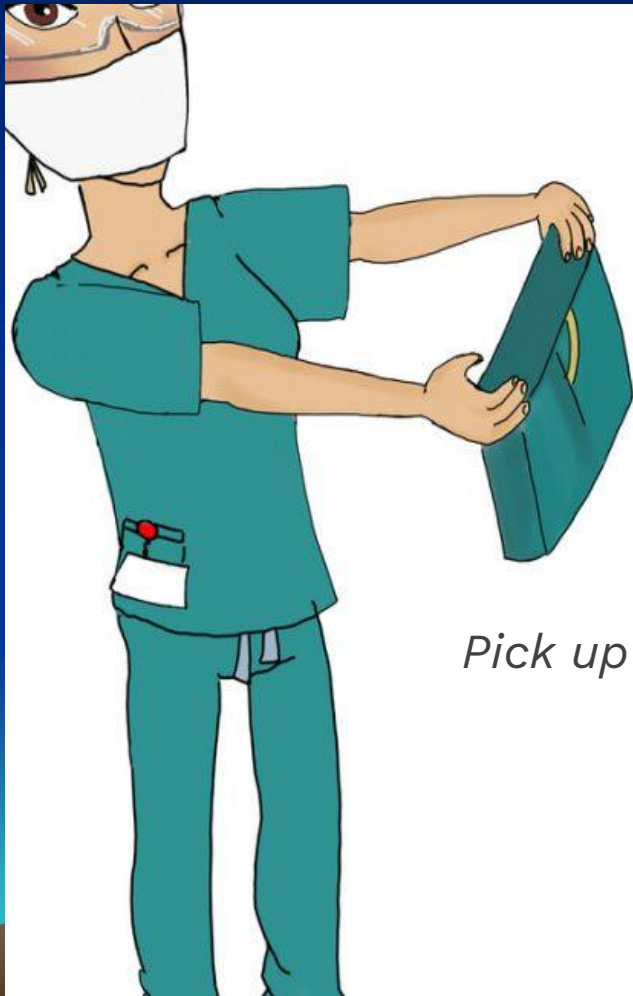
- **The hand disinfection methods**
- **•Classic method Spasokukotsky-Kochergin:**
- **•Running water with soap 10 minutes**
- **•Warm 0,5 per cent ammonium hydroxide solution / 2 x 3 minutes/ •96 per cent ethyl alcohol/ 2 x 2,5 minutes**



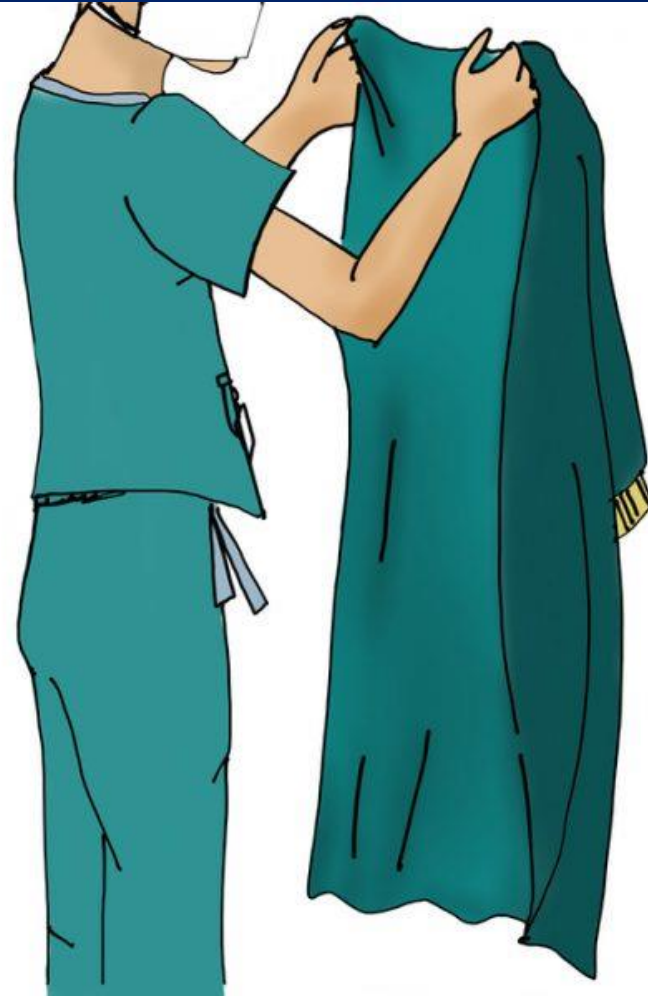
Modern method:

- **With Pervomur:** /formic acid 85%,81 ml
+hydrogen peroxide 33% 171 ml
 - Running water with soap – 1 min
 - 2,4 per cent solution of pervomur - 1 min
 - dry with sterile napkin
- **With hibitan, Hibiscrub, Chlorhexidine -**
 - 0,5%
 - Running water with soap- 1 min
 - 0,5 per cent solution Hibiscrub, Chlorhexidine /
3 minutes

gowning

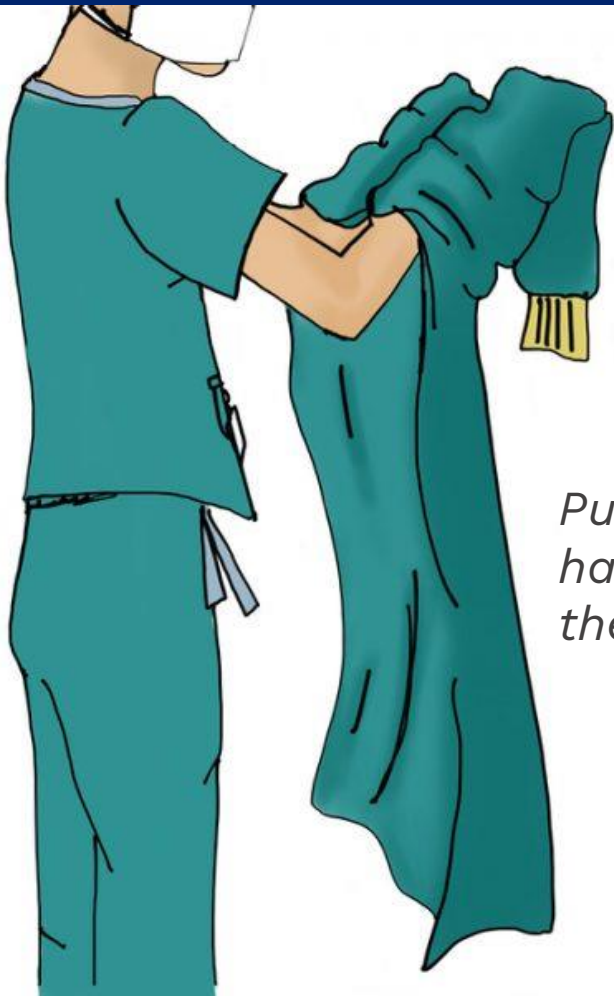


Pick up gown pack

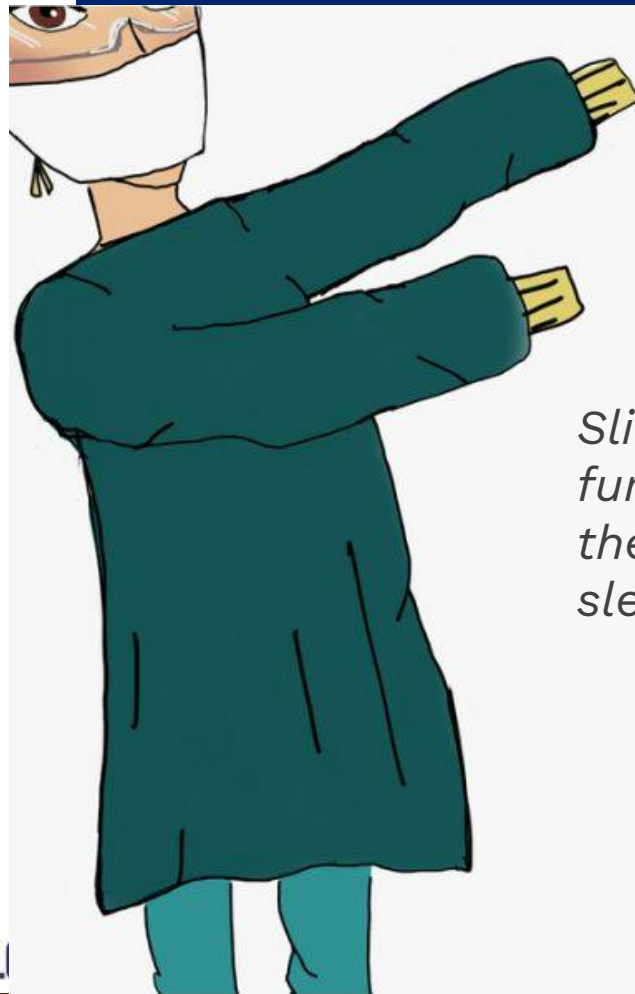


*Open
the
gown*

gowning

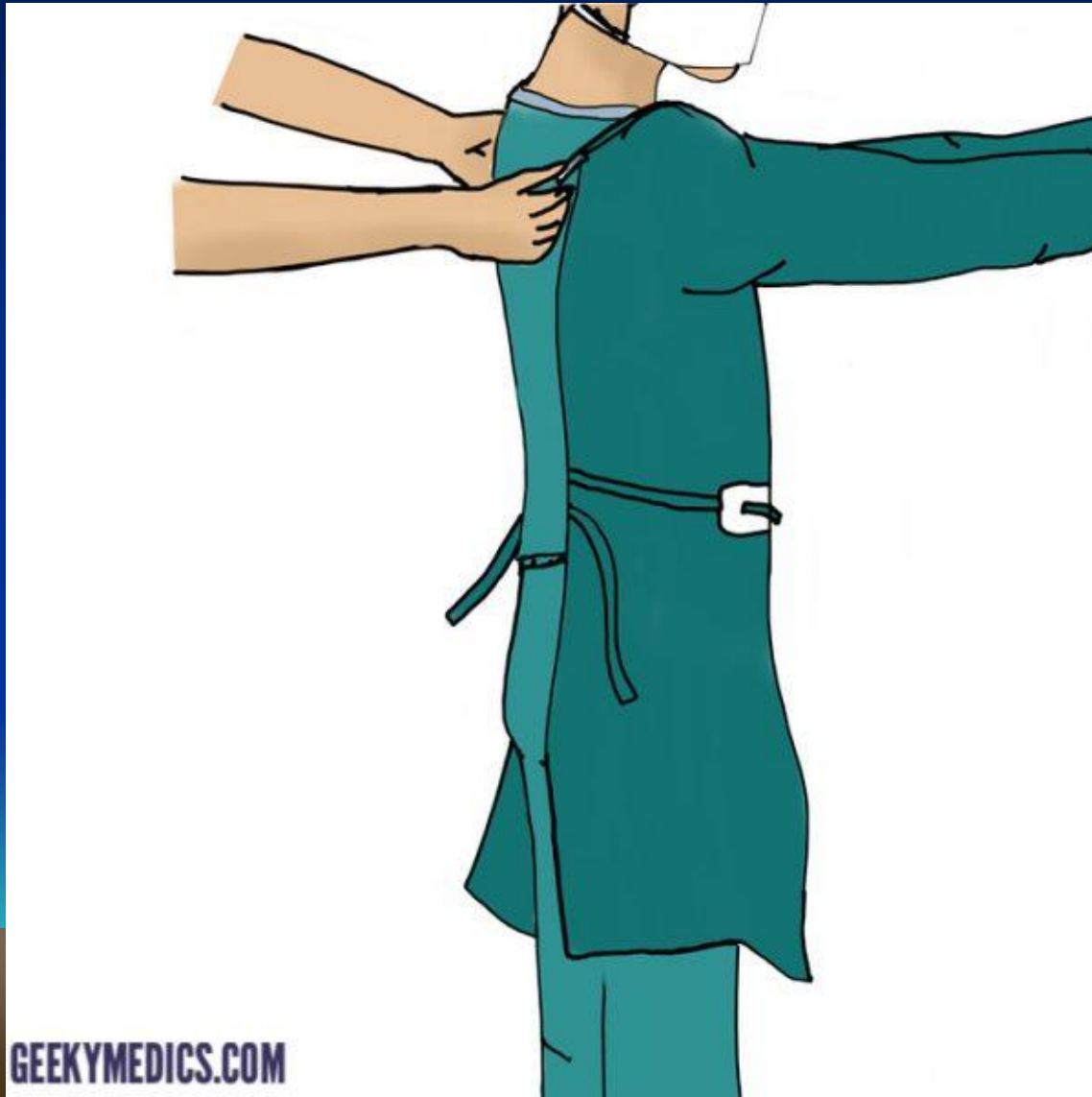


Put your hands into the sleeves



Slide your arms further down the gown sleeves

An assistant should fasten the gown behind you



Gowning Another Person



The gown is held by the shoulder seams with the outside facing the sterile person.



The arms are slipped into the sleeves in a downward motion, sliding the gown up to the mid-upper arms.

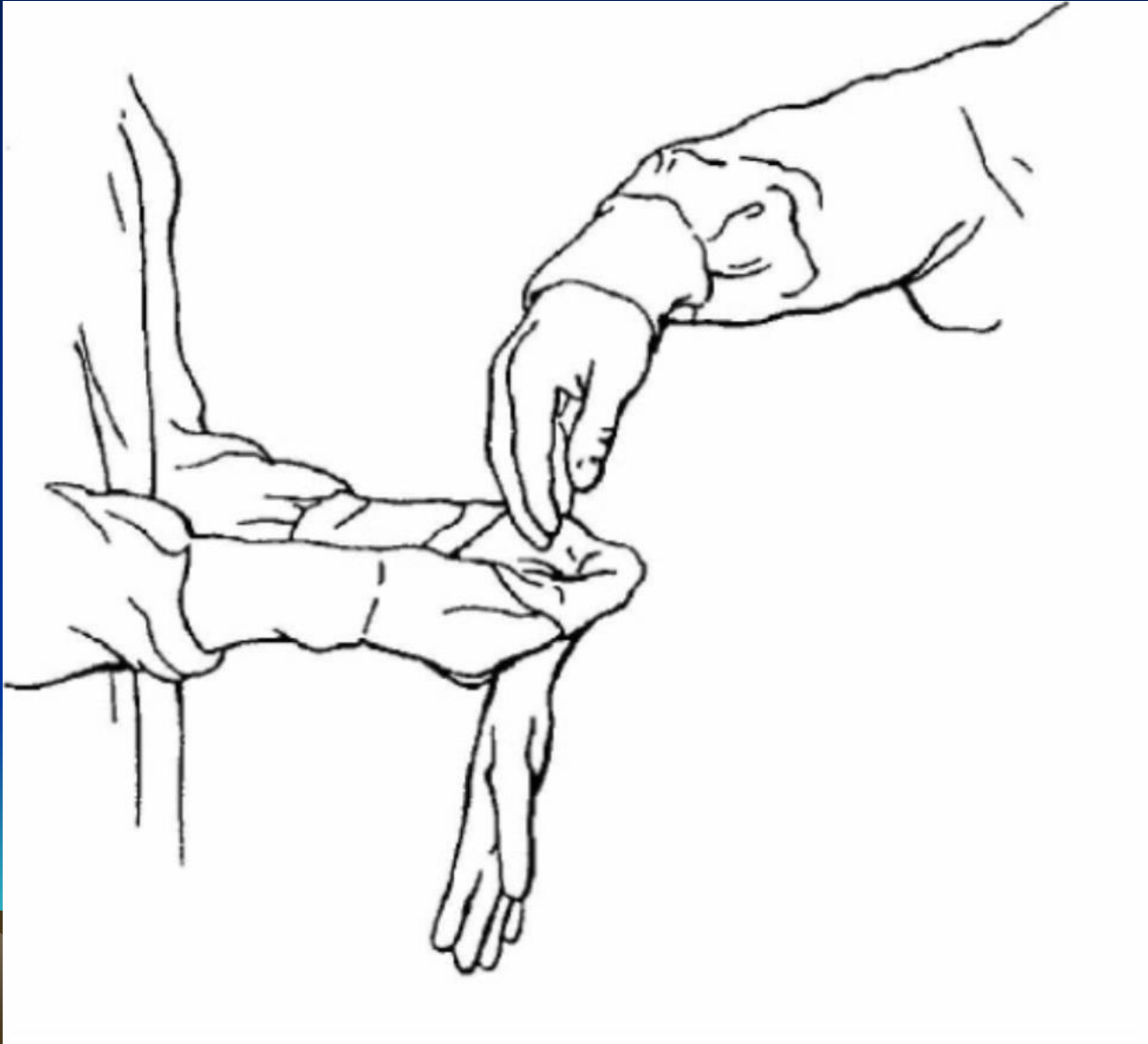
The circulator assists in pulling the gown up and tying it



Gently pull the cuffs back over the person's hands.

Gloves

- To prevent transmission of blood borne viruses (HBV,HIV) from patient to surgeon
- To prevent transmission of micro-organism from surgeon to patient



Gloves:

There is little evidence to suggest that glove puncture increases surgical wound infection, which suggests that hand washing is of great importance. Studies suggest that an average of 18% of gloves are punctured and 90% of these occur in operations lasting longer than 2 h. Approximately 40,000 organisms can pass through a glove pin hole in a 20 min period. The most commonly punctured finger is the left index finger. Double gloving affords a greater protection to the surgeon, but at the cost of decreased dexterity and comfort.



Preparation of the surgical instruments

Surgical instruments used during operative procedures are prepared by cleaning, disinfection and sterilization



Cleaning: Removal of organic debris must be undertaken prior to disinfection or sterilization to prevent the transmission of infection.

Disinfection: This is usually undertaken using automated washing processes. Disinfectants are chemicals employed to disinfect inanimate objects.



Sterilization:

This process can be undertaken by;

- _ steam(**autoclaving**)
- _ hot air(**ovens**)
- _ ethylene oxide
- _ steam and formaldehyde
- _ irradiation.



Physical methods

Dry heat: (180 C - 1 HOUR)

Hot air oven

Metalic objects like

Forceps

Needles

Scalpels

Scissors

Glass wares

Syringes

Petri dishes

test tubes

Pipettes

Chemicals

Powders



Dry heat ovens are used to sterilize items that might be damaged by moist heat or that are impenetrable to moist heat (e.g., powders, petroleum products, sharp instruments).



The hot air oven is the most commonly used form of dry heat sterilization.

Physical methods

INCINERATION:

DESTRUCTION

OF INFECTIVE

MATERIALS

SOLID DRESSING

BEDDING

SPUTUM STOOL





Moist heat sterilization processes sterilize using hot air that is heavily laden with water vapor, which plays the most important role in the sterilization.

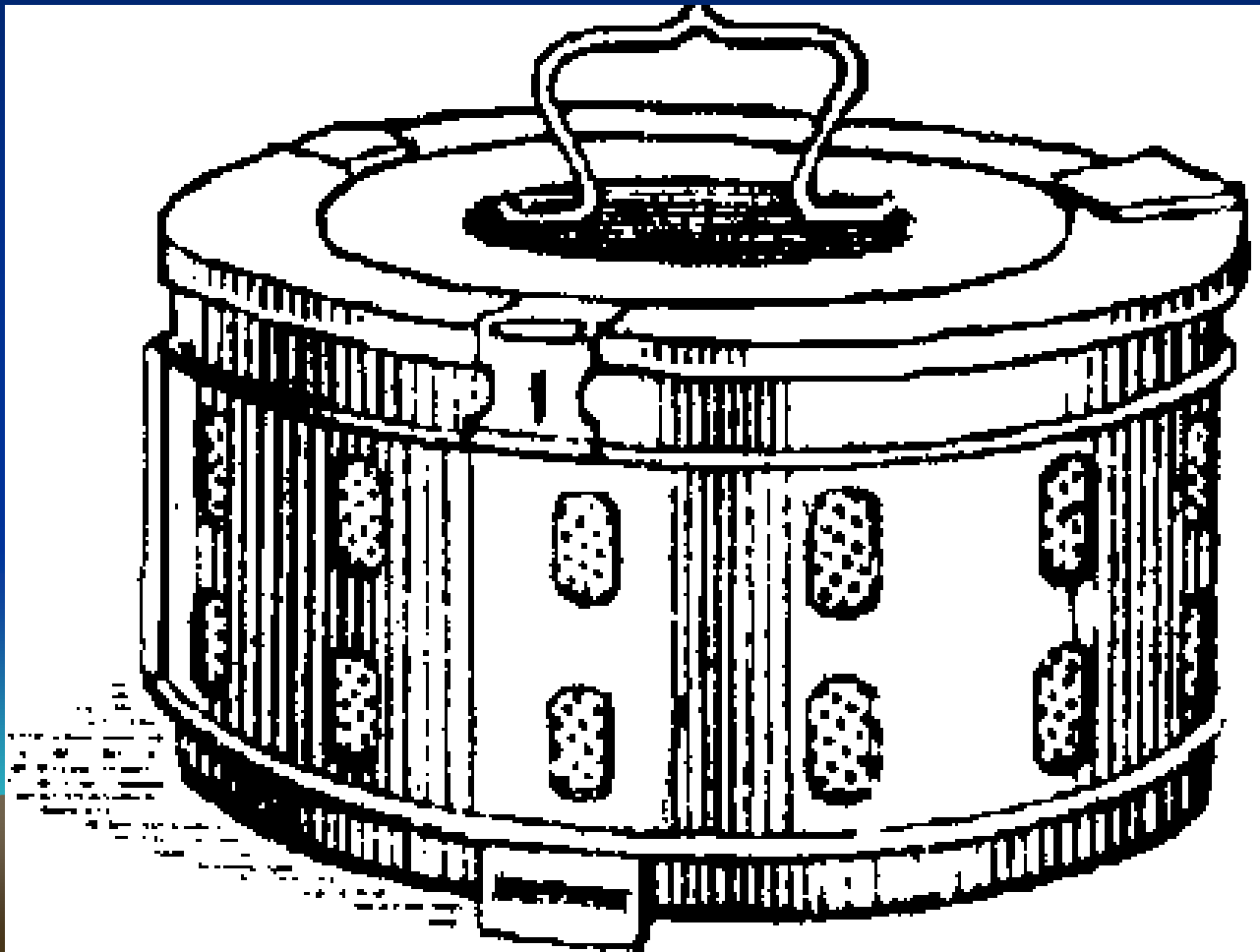
Dressing and linen are sterilized in autoclaves,

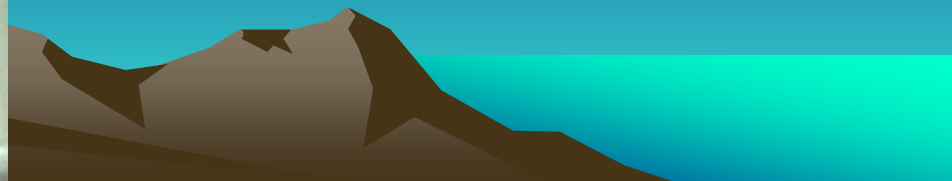
- At temperature 120°C, pressure of 1,1 atmosphere during 60 minute;
- At temperature 126,8°C, pressure of 1,5 atmosphere during 45 minute;
- At temperature 132°C, pressure of 2 atmosphere during 20 minute;



Sterilization of dressing and operational linen

Linen can be kept in 2 days.
Schimmelbuch dressing box







Autoclave effective
against
Vegetative bacteria
including TB
VIRUSES
HDV and HIV
Heat resistant spores – Cl.
Tetani
Cl. perfringes



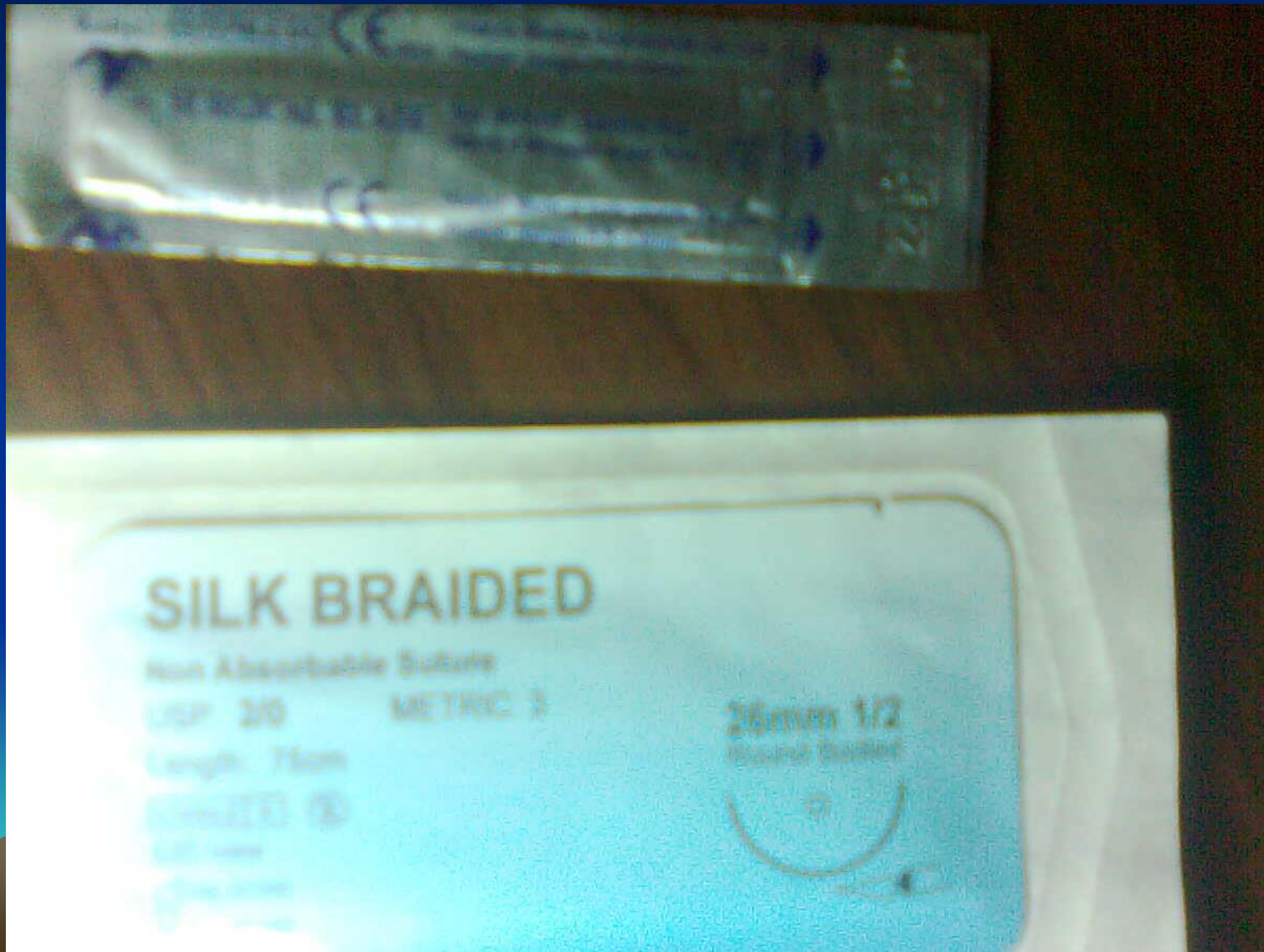
IRRADIATION Radiation

used for sterilization is of two types

1. Ionizing Radiation X-rays, gamma rays and cosmic rays are highly lethal to DNA and other vital constituents. They have high penetration power. There is no appreciable increase in temperature, thus referred to as cold sterilization. Commercial plants use gamma radiation for sterilizing plastics, syringes, swabs, catheters etc.



Ionising radiation



Non-ionizing radiation

Two types of non-ionizing radiations are used for sterilization:-

- A. Ultraviolet -Short range UV(UVC) is considered “germicidal UV”.
 - At a wavelength of 2537 Angstroms UV will destroy micro-organismal DNA.
 - Used mainly for air purification and water purification in hospitals.
- B. Infrared –It is most commonly used to purify air, such as in the operating room. Infrared is effective, however, it has no penetrating ability.

Ultraviolet radiation



Ethylene Oxide Sterilization (ETO)



- Used almost exclusively to sterilize medical products that cannot be steam sterilized or sensitive to radiation.
 - Mechanism of action: It destroys micro-organisms by alkylation and cause denaturation of nucleic acids of micro-organisms.
 - At 30 °C - 60°C with relative humidity above 30 % and gas conc. between 200 and 800 mg/l for at least 3 hours.

Ethylene oxide

- is a colorless liquid with a boiling point of 10.7 °C. □ Highly penetrating gas with sweet ethereal smell.
- Highly inflammable
- Plastics, rubber & photographic equipments can be sterilized by this method.
 - Also used for mass sterilization of disposable items, plastic syringes, needles, catheters, blades etc.



Preparation of the operating theatre

The temperature should be regulated between 19 and 22 °C and humidity between 45 and 55%. and with such external ventilation that assure the air change 3-4 time during one hour.

The air disinfection inside the operation room is made by ultraviolet bactericide lamp.





Methods for attaining asepsis and antiseptics in the operation room or operation room aseptic regim.

In the operation blok we usualy have the following zone of sterility:

The zone N1 – steril zone where included operation room and sterilization room.

The zone N 2 – the zone of strict regim, included the room that is situated near and connect directly with the operation room – anesteziologist room, room for preoperative prepare.

The zone N 3 – the zone of limited regim - surgeons rooms, medical asistans rooms, laboratory for emergency analisis, the room for blood keeping.

The zone N 4 – the zone of habitual hospital regim.



The steps of cleaning inside de operation room:

1. Curent clearning during the operation.
2. Clearning of the operation room after the operation.
3. Daily clearningig at the end of the operation day.
4. The general clearning of the operation rooms that perform weekly.
5. Every morning wet clearning of orizontal surfaces.



Cleaning of the operating room

Cleaning of the room is done by a damp cloth (1 % chloramin, 3 % hydrogen peroxide, 0,5 % detergents).

- **The current cleaning** - they pick balls of cotton from the floor; wipe the blood from the floor.
- **The cleaning of the operating room after the operation** provides its cleanliness before the next operation.
- **The every day cleaning at the end of the operational day and after some extra operations.**
- **The general cleaning is fulfilled once a week according to the plan, in a day free from operations** - they use hot water with soap, 3-6 % solution of hydrogen peroxide, 0,5 % solution of detergent.
- **In the morning before the beginning of work all horizontal surfaces are wiped by means of a damp cloth. Bactericidal ultraviolet lamps are used for disinfections of air.**





Principles of Aseptic Technique

- Aseptic Technique = methods by which contamination with microorganisms is prevented
- Only sterile items are used within the sterile field
 - Sterile persons are gowned and gloved –
Gowns are only sterile from waist to shoulder –
Gloved hand must be kept in sight at all times
 - Only the top of a draped table is considered sterile
 - Sterile persons touch only sterile items or areas



Methods for attaining antiseptics. Type of antiseptic factors

1. Mechanical antiseptics

A. Surgical technique – debridement

B. Mechanical removal of bacteria from surface of the different objects

2. Biological antiseptics include the use of different antibiotics, serum, vaccines, phages

3. Physical antiseptics include different physical factors such as light, ultrasound, radiation, ultraviolet wave, laser wave and so on.

4. Chemical antiseptics

Types of antiseptis

Physical - the creation of unfavorable conditions for development of microorganisms in a wound and for suction of microbe toxins and products of tissue decay. The drainage provides the outflow of wound contents and promotes the removal of toxins, microbes and products of tissue decay. Irrigation of gauze with hypertonic solutions highly increases its hydroscopic quality but tampons with wound exudation prevent the outflow from the wound, which is why they are not good for drainage.

The open method of treatment can be used (ATU). The wounds are dried; as a result, unfavorable conditions for development of microorganisms are created.



The drainage provides the outflow of wound contents and promotes the removal of toxins, microbes and products of tissue decay



Pleural space drainage



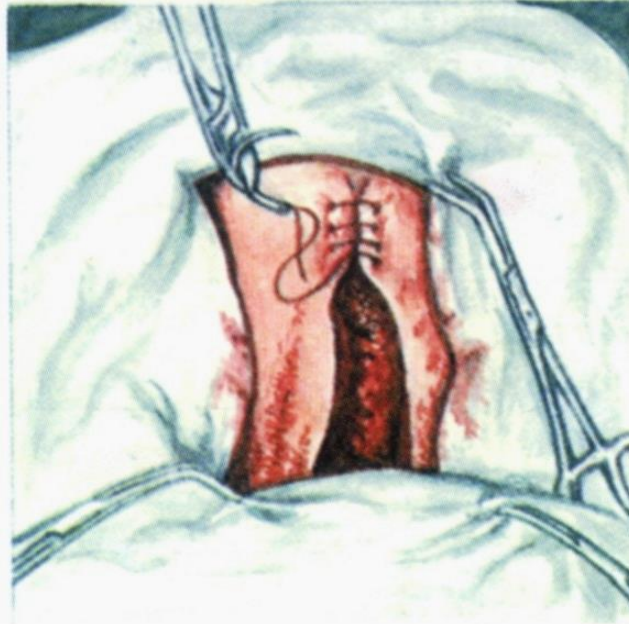
The mechanical antiseptics: the hygienic bath, shaving, and extermination of tissues lacking vital capacity. In 1898 Fridrih P. proposed the primary surgical treatment of a wound by means of cutting off its borders, walls and a bottom within healthy tissues.

Chemical - the use of different chemical substances with bacterial and bacteriostatic effects. These substances must be safe for the human organism and its cells. They are used for treatment of the operational field, hands of a surgeon, sterilization of gloves, surgical instruments, stitch materials, disinfection of rooms.

Biological - is the procedure aiming to increase the immunity and to strengthen the protective power of an organism. A includes specific vaccines, immuno-serums, globulin, blood transfusion, plasma, anatoxins.

Mixed - the simultaneous use of some types of antiseptics. For example for treatment of wounds: the primary surgical treatment is mechanical, washing a wound and surrounding skin - chemical, the use of antibiotics -biological, putting the dressing-physical.






Prophylactic antibiotics

Prophylactic antibiotics should be given in any instance where contamination of a wound may be anticipated. They are not advocated in clean procedures except for the placement of a prosthesis where infection would be disastrous. The antibiotic chosen should be effective against the likely infecting pathogens. Intravenous dosing is advised to ensure good tissue penetration. Antibiotics are usually given **one hour before the procedure or 15 min prior to the induction of anaesthesia** or inflation of tourniquets. A second dose should be administered if a procedure lasts more than 4 h.



SUBSTANCES.

1. **THE GROUP OF HALOIDS** - the derivatives of chlorine and iodine. Their interaction with hydrogen of a microbe cell causes coagulation of protoplasm proteins. We use chloramin B (0,5 – 2% solution), iodonate (1% water solution), uodopiron, and iodophorm.
 2. **OXIDANTS**, getting in contact with tissue, release oxygen with possesses a strong oxidizing effect, thus unfavorable conditions for anaerobic and putrefactive microbes are created. We use: the solution of hydrogen peroxide (3% water solution), potassium permanganate (0,1-2% water solution).
 3. **ACIDS AND ALKALIS** - more often salicylic acid and boric acid, sodium hydrocarbonat are used.
 4. **ALDEHYDES** are strong bactericidal preparations: formaldehyde, glutaldehyde, and hexamethylentretamine. Severe toxic.
- 



5. ALCOHOLS

1.
 - Act by denaturing bacterial proteins. • Solutions of 70% ethanol are more effective than higher concentrations, as the presence of water speeds up the process of protein denaturation as reported by Lawrence and Block (1968). • Frequently used for skin antisepsis prior to needle puncture. • Used for disinfection of clinical thermometer .



HYPERTONIC SOLUTIONS - are weak antiseptics possessing irritating and counter-attracting effects. We use the hypertonic solutions of sodium chloride (10%), glucose (10% and 40% solutions).

SALTS OF HEAVY METALS - are strong and drastic antiseptics blocking sulphohydryl groups and causing the protein coagulation of microorganisms. Many substances of this type are not used now because of their toxic effects. We use the preparations of silver.

PHENOLS They denature and coagulate proteins of protoplasm in bacteria. There are phenocarbolic acid, birch tar, ihtiol, and naphtalene oil.

DYESTUFFS – are organic combinations dying tissue and possessing bactericidal effect: methylene blue, brilliant green, and acridine lactate (rivanol).

0. **Detergents** – are drastic surface-active combinations, relating to the group of ammonium bases. They are widely used in surgery and an operating field. They are widely used in surgery for treatment. There are cerigel, degmicide, hexidine chloride, roccal etc.