Disinfection and sterilization

Disinfection and **sterilization** in medical facilities are operations performed by trained medical staff. The used procedures and means are subject to the approval of the Chief Hygienist of the Czech Republic and are regulated by the relevant hygienic legislation. The following procedures are distinguished according to the degree of removal of microorganisms from the object or environment:

- mechanical cleaning;
- disinfection;
- a higher degree of disinfection;
- sterilization.

Mechanical cleaning - sanitation

Disinfection of the bed used to transport the patient

A set of procedures that mechanically remove impurities and reduce the number of microorganisms. Depending on the type of workplace, common detergents or detergents with a disinfectant are used (according to the hygienic-epidemiological regime of the specific workplace). Furthermore, cleaning agents or cleaning agents with a disinfecting effect are used. These are applied either manually or using washing and cleaning machines, pressure guns, ultrasonic devices, etc.

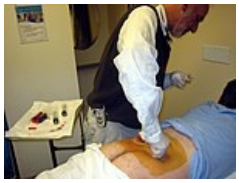
All aids and devices are kept clean. Cleaning aids are disinfected and dried after use. Cleaning machines and other equipment are used according to the manufacturer's instructions. Cleaning is done daily wet.

Disinfection

SODIS (Solar Water Disinfection) – PET-bottle and sunlight water disinfection methods used in some developing countries

It is used to destroy **pathogenic microorganisms** in the environment. A set of measures for the control of microorganisms using **physical** (temperature above 90 °C), **chemical** (use of chemicals) **or combined processes** (temperature above 60 °C + use of chemicals). These are supposed to interrupt the path of infection from the source to the susceptible individual.

- **Prophylactic, preventive:** it is performed even when the infectious disease does not occur, it is part of complex hygienic measures, (chlorination of water, pasteurization of milk, wastewater treatment).
- **Repressive, focal:** in the outbreak of the disease; is ongoing or final, it is aimed at eradicating pathogens in the outbreak in order to interrupt the further spread of the infection.



Disinfection before bone marrow collection

The choice of disinfection is important, it is necessary to take into account the individual types of microorganisms:

1. susceptibility of individual micro-organisms;
2. effect;
3. influence of temperature and pH;
4. the product must act on the whole surface and must not allergen;
5. It must be economically advantageous.

Physical disinfection

- boil at atmospheric pressure for at least 30 minutes;
- boil in pressure vessels for at least 20 minutes;
- disinfection in washing and steam appliances at a temperature higher than 90 °C;
- [[UV radiation|UV radiation] with a wavelength of 253,7–264 nm;
- filtration, annealing, combustion.

Chemical disinfection

According to the method of use

- surface disinfection;
- disinfection of tools;
- hand disinfection;
- special disinfection.

According to the active substances

- Chlorine compounds (eg sodium hypochlorite - SAVO®),
- iodine compounds (eg JODISOL®),
- aldehydes,
- quaternary ammonium compounds (KAS),
- phenol derivatives, alcohols,
- peroxide compounds (have oxidizing and reducing character),
- hydroxides (eg sodium hydroxide)
- amines,
- surfactants – chemical surfactant compounds (the most important are ammonium quaternary compounds),
- organic acids.

According to the spectrum of efficiency

- Bactericidal,
- virucidal,
- fungicidal,
- tuberculocidal,
- sporucidal.

Depending on the place of use

- Healthcare,
- the food industry, etc.

Physicochemical disinfection

- Vapor-formaldehyde chamber (disinfection of textiles, plastic products, wool, leather and furs at a temperature of 45 to 75 °C).
- Washing and cleaning machines (disinfection takes place at a temperature of up to 60 ° C with the addition of chemical disinfectants).

Principles of chemical disinfection

- Disinfectants and procedures that do not damage disinfected material and are non-toxic.
- Prevention of selection or resistance of microbes to the product - disinfectants alternate with different active ingredients.
- In the preparation of disinfectant solutions, it is assumed that their names are so-called "word marks" and the products are considered to be 100%[1].

- Disinfectant solutions are prepared by dissolving the measured / weighed disinfectant in the water.
- The frequency of replacement of disinfectant solutions is given by the manufacturer's recommendation (most often each change is performed, depending on the degree of loading of biological material and more often).

Physicochemical disinfection

- Improving the effectiveness of some disinfectant solutions can be achieved by increasing the temperature (phenolic preparations and quaternary ammonium compounds to 50 to 60 °C, iodine preparations to 35 °C).
- Aldehyde, chlorine and peroxy compounds are diluted with cold water.
- Disinfection is carried out by washing, wiping, immersion, spraying, foaming or aerosol.
- It is important to adhere to the concentration and duration of the disinfectant prescribed in the instructions.
- Objects and surfaces contaminated with biological material are disinfected with a virucidal product.
- When using disinfectants with washing and cleaning properties, the cleaning and disinfection stage can be combined.

(*Procedure:* disinfection - mechanical cleaning; disinfection.)

- Items that come into contact with food must be thoroughly rinsed with drinking water after disinfection.
- Adherence to the principles of health and safety at work and the use of personal protective equipment, workers are instructed on the principles of first aid.
- We use microbiological methods (smears and prints) to verify the effectiveness of disinfection.

A higher degree of disinfection

- Guarantees killing of all microorganisms, but not cysts of protozoa, helminth eggs, etc.
- Two-stage disinfection:
- ***procedures that guarantee the killing of bacteria, viruses, microscopic fungi and certain bacterial spores***, but do not guarantee the killing of other microorganisms (highly resistant spores) and the developmental stages of health-relevant protozoa, helminths and their eggs.
- Disinfectant solutions for a higher degree of disinfection must be stored in closed containers.
- The frequency of replacement of disinfectant solutions is specified in the instructions for use of each product.

- Devices subjected to a higher degree of disinfection are intended for immediate use or are stored for a short time covered with a sterile drape in closed cassettes and cabinets (loose - in 24 hour cassettes, protected - in cassettes and closed cabinets for 48 hours).
- After use, items are cleaned (mechanically or manually) and dried.
- In case of contamination with biological material - disinfection with a product with a virucidal effect, then dry objects are immersed in solutions intended for a higher degree of disinfection so that all hollow parts are filled without air bubbles.
- After a higher degree of disinfection, it is necessary to rinse the objects with sterile water, remove residues of disinfectants, sterile drying and it is also necessary to treat the objects as sterile instruments.

References

Related articles

- Sterilization (hygiene)
- Disinfectants and antiseptics
- Antisepsis
- Asepsis
- Cultivation certificate for hand disinfection

References

- KOLEKTIV AUTORŮ,. *Základy ošetřování nemocných.* 1. edition. Praha : Karolinum, 2005. 145 pp. ISBN 80-246-0845-6.
- MIKŠOVÁ, Z, et al. *Kapitoly z ošetřovatelské péče I..* 2. edition. Praha : Grada, 2006. 248 pp. ISBN 80-247-1442-6.
- MIKŠOVÁ, Z, et al. *Kapitoly z ošetřovatelské péče II..* 2. edition. Praha : Grada, 2006. 171 pp. ISBN 80-247-1443-4.
- RICHARDS, A – EDWARDS, S. *Repetitorium pro zdravotní sestry.* 1. edition. Praha : Grada, 2004. 376 pp. ISBN 80-247-0932-5.
- ROZSYPALOVÁ, M – ŠAFRÁNKOVÁ, A. *Ošetřovatelství I., II..* 1. edition. Praha : Informatorium, 2002. 239 pp. ISBN 80-86073-97-1.
- WORKMAN, B – BENNETT, C., L.. *Klíčové dovednosti sester.* 1. edition. Praha : Grada, 2006. 259 pp. ISBN 80-247-1714-X.

References

1. Česká republika. Ministerstvo zdravotnictví. Předcházení vzniku a šíření infekčních onemocnění. In *440/2000*. 2000. Available from <http://www.zdrav.cz/modules.php?op=modload&name=News&file=article&sid=1911>.

Sterilization *is a set of measures that kill all viable microorganisms in a given environment, including spores and helminths with their eggs, and also irreversibly inactivate viruses.*

Pre-sterilization preparation

- Decontamination or disinfection,
- mechanical cleaning,
- rinsing with drinking water or distilled water,
- drying,
- packaging.

Physical sterilization

Moist heat sterilization

- In steam appliances, which must, with some exceptions, be equipped with a regularly changing antibacterial filter,
- sterilization of objects made of metal, glass, porcelain, ceramics, textiles, rubber, plastics, medicinal products and other materials resistant to parameters,
- a temperature of **134 °C** is used for inactivation of prions for 60 minutes,
- for some unpackaged items intended for immediate use, the temperature is **134 °C** for 4 minutes, it is not used in central sterilization and sterilization centers,

- for medicinal products, parameters are used individually according to standard operating and technological procedures.

Hot air sterilization

- In devices with forced air circulation,
- sterilization of objects made of metal, glass, porcelain, ceramics, earthenware and medicinal products at parameters,
- for medicinal products, parameters are used individually according to standard operating and technological procedures.

Plasma sterilization

- It is formed in a high-frequency electromagnetic field or high-voltage discharge, which releases hydrogen peroxide vapors or other chemicals in a high vacuum by free oxygen radicals; the effect is given by a low-temperature gas plasma (hydrogen peroxide, peracetic acid) at a temperature of **50 °C** and other specified parameters.

Chemical sterilization

- Material that cannot be sterilized by physical means,
- The sterilizing medium is gases of the prescribed composition and concentration.

Formaldehyde sterilization

- Effect of gaseous mixture of formaldehyde with water vapor at a temperature of 60–80 °C and a vacuum at the parameters specified by the manufacturer,
- aeration of the chamber at the end of the cycle takes place through an antibacterial filter.

Ethylene oxide sterilization

- Gaseous mixture of [[ethylene oxide] at a temperature of **37–55 °C** at the parameters specified by the manufacturer.

Principles of sterilization

- We choose sterilization methods according to the recommendations of the manufacturer of individual instruments / aids / objects,
- tools / aids / objects are sterilized thoroughly washed and dried,
- the materials are placed in suitable containers and stored in the sterilization chamber in such a way as to allow the sterilization medium to penetrate as easily as possible,
- packages with sterilized material **are marked** with the date of sterilization, expiration, worker code (responsible for the integrity of the package) and process test control,
- each sterilization cycle **is documented:** date, type of sterilized material, name and signature of the person who performed the sterilization,
- sterilized material in the packaging **is transported** in closed crates so that they are protected from damage and contamination,
- **sterilized material is stored:**
  - free with a short expiration time,
  - protected in a closed cabinet, drawer or other packaging with a longer expiration date,
  - for long-term expiration, a double package is used, which after sterilization is inserted into a closable storage package (eg cabinets),
  - For better handling of sterile material during its use, it is possible in exceptional cases to use feeding tongs, which are stored "dry" in the quiver, when the change of feeders and quivers must be performed at least once every 8 hours.

Checking the effectiveness of sterilization devices

Biological indicators

- New devices, repaired devices before commissioning,
- in case of any doubt about the sterilization efficiency,
- **regular inspection:**
  - *once a month: sterilizers in sterilization centers, central sterilizations, operating rooms, operating tracts or workplaces that perform sterilization for other workplaces,*
  - *for sterilizers not older than 10 years at the latest after 200 sterilization cycles, but at least once a year,*
  - *for sterilizers older than 10 years, at the latest after 100 sterilization cycles, but at least twice a year.*

Non-biological tests (monitoring of sterilization parameters by the operator)

- **Process chemical test**
  - each unit package is marked,
  - serves to distinguish material ready for sterilization and already sterilized, responds by color change only

to the presence of sterilization medium,
- **chemical tests:** designed to demonstrate compliance with all cycle parameters; they are inserted in places where the sterilization medium penetrates the worst.

References

Related articles

- Antisepsis
- Asepsis
- Disinfection
- Sterilization (dentistry)

External links

- Sterilization (microbiology)