



MEDICAL UNIVERSITY - PLEVEN
FACULTY OF MEDICINE

DISTANCE LEARNING CENTRE

**DEPARTMENT OF INFECTIOUS DISEASE, EPIDEMIOLOGY,
PARASITOLOGY AND TROPICAL MEDICINE**

LECTURE № 2

FOR E-LEARNING IN „INFECTIOUS DISEASE EPIDEMIOLOGY“

**SIXTH YEAR MEDICAL STUDENTS -
TRAINEE DOCTORS**

TITLE: DISINFECTION, DISINSECTION, DERATIZATION

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DISINFECTION AND STERILIZATION

Disinfection as a prophylactic subject includes a series of actions aimed to destroy the pathogenic microorganisms in the outer environment and on the human body surface (skin, mucous membrane).

Sterilization is a variety of the disinfection. Sterilization is the process of destroying all microorganisms in their different forms (vegetative and spore).

Sanitization is sharp microbe flora diminishing on a subject, e.g. after washing. It seems that contamination on the subject has vanished, but quantitatively there isn't any proof positive.

Antiseptics' aims for annihilation of microorganisms on the human body skin and mucous membrane.

Disinfection is used because pathogenic microorganisms that are spread upon the objects of the outer environment (instruments, surfaces, things used by the ill person) easily affect new receptive individuals.

According to the aims and tasks, **disinfection** is divided into:

Prophylactic (precurrent) disinfection – it is done in places without source of infection but with suitable conditions for its appearance, or in places where the high contamination of pathogenic microorganisms should be avoided – health centers, kindergartens, baby kitchens. Disinfection of water by chlorine, pasteurization of milk.

Disinfection in the centers of infection – it is done in the infectious centre. It includes decontamination of the places where the ill person stays and the different objects of the outer surroundings. This disinfection can be: **concurrent**– during the period of the illness and **terminal** – after the recovering of the ill person or after his death. Concurrent disinfection consists of usually disinfection of urine, faeces, vomit, contaminated linen, clothes, hands, dressings, aprons, throughout the course of an illness. The well-done concurrent disinfection is of great help for the terminal one.

Main factors that determine the disinfection process:

1. The agent stability
2. Time of influence (exposition)
3. Concentration
4. Penetrating
5. Temperature
6. Solubility
7. Quantity
8. Reaction and characteristic of the objects of outer environment.

Methods of disinfection

I. Biological method. It is based on the microbe antagonism in the Nature. It is not applied in the anti-epidemic practice.

II. Mechanical method.

1. Mechanical clearance
2. Ventilation
3. Filtration

III. Physical method

1. **Sunlight**
2. **Ultraviolet rays** – special bactericide lamps.
3. **Super-sound** – used for pre-sterilization instrument clearance.
4. **Ionizing radiation** – gamma rays and electronic rays.
5. **Heat**

5.1 Burning: Burning is used for burning infected materials. In many hospitals there are ovens where great quantities of waste materials are burned.

5.2. **Dry hot air.** Dry hot air is applied in sterilization of metal, glass and porcelain objects. Dry sterilization is guaranteed when the following temperature conditions and time of treatment are observed:

- 160 degrees C for 2 hours
- 170 degrees C for 1 hour
- 180 degrees C for 30 minutes

5.3. Humid heat

- **Boiling.**
- **Autoclaving.** Sterilization with steam under pressure is done in sterilizers with manual and programmed automated control. The following regimes are used:
 - T 121C, pressure 1,15 bars, exposition 20 minutes for automated and 30 minutes for those with manual control.
 - T 134 C, pressure 2,16 bars, exposition 10-12 minutes for automated and 20 minutes for those with manual control.

IV. Chemical method

Disinfectants means has to meet the following conditions:

1. To have high bactericide activity
2. To be harmless and to have low toxicity
3. Not to damage processed objects
4. To have conservation stability
5. To be water soluble
6. Not to have nasty smell
7. Not to be inactivated by proteins and other organic materials
8. To be available and cheap

Forms of appliance: solutions, bactericide soap, aerosols.

Decontamination of different objects in outer environment with chemical means is done by the following **methods:** soaking, wiping, sprinkling.

Major Classes of Chemical Disinfectants

1. Acids
2. Alkalis
3. Halogens
 - Chlorine compounds – chlorine containing tablets
 - Iodine compounds – iodascept, iodoform-5
4. Phenol and related compounds – chlorine, helipur, idophen
5. Aldehydes – formaldehyde, paraformaldehyde tablets, glutaraldehyde
6. Alcohols – ethyl alcohol, isopropyl alcohol
7. Oxidating substances – hydrogen peroxide, peracetic acid
8. Surface Active Substances – quaternary ammonium compounds
9. Biguanids /chlorhexidine compounds/ - hybitane, hybiscrub, ido-scrub
10. Aerosol disinfectors – ethylene oxide
11. Combined

Decontamination of epidemically important basic objects at health centres

1. Hands disinfection - hygiene and surgical hands disinfection
2. Instruments disinfection and sterilization
3. Disinfection of special medical installations
4. Hospital and working clothes disinfection
5. Disinfection of feeding utensils
6. Disinfection of laboratory glass-ware
7. Surface disinfection
7. Disinfection of ill person secrets and excreta
8. Disinfection of things for servicing the ill person

Regional Inspection of Health provides methodical observance in health centers for disinfection and sterilization problems and periodically controls them. This control is planned and under epidemiological evidences. This planned control is done at least two times yearly.

Sterilization control:

1. Physical control – thermometers and manometers for temperature and pressure reading are used.
2. Chemical control – color paper indicators that change their color at a given temperature are used - for daily sterilization control.
3. Microbiological control.

Basic methods for disinfection microbiological control:

1. Method of marked microbe crops
2. Method by tampon washing
3. Method for microbe number in disinfection solutions defining
4. Method of test carriers

DISINSECTION (VECTOR CONTROL)

1. Background of vector control

- Early control programmes – screening of houses, use of mosquito nets, drainage of swamps;
- Programmes for control and eradication of the most important vector-borne diseases by large-scale application of DDT (1950-1960);
- Reorganization of vector control:
 - Self-protection measures;
 - Community control.

2. General principles of vector control

2.1 Environmental control – intensive health education of the public as well political support are of essential importance:

- altering the breeding sites of vectors;
- filling and drainage operation;
- carefully planned water management;
- provision of piped water supply;
- cleanliness in and around houses.

2.2 Biological control – the use of living organism or their products. The aim is to kill larvae without polluting the environment. Biological control often works best in combination with environmental management.

2.3 Genetic control – cytoplasmic incompatibility, chromosomal translocations.

Combination of the genetic methods with other methods – insect growth regulators, chemosterilants.

2.4 Chemical control – use of insecticides for killing insects and other arthropods.

Pesticides – general term that includes insecticides, herbicides, disinfectants, repellents and other chemicals used for the control of pests.

Insecticides – substances which are used to kill insects.

Classification of insecticides:

1. According to the **route of penetration** in the insect body:

- Contact poisons;
- Stomach poisons;
- Fumigants.

2. According to the **chemical characteristics:**

- Organo-chlorine compounds - DDT;
- Organo-phosphorus compounds – Malathion, Abate, Chlorpyrifos, Dichlorvos;
- Carbamates - Carbaryl;

- Synthetic pyrethroids – Pyrethrin, Cipermethrin, Tetramethrin.
3. **Repelents** – compounds that drive away or prevent biting, irritation by insect pests - DEET.
 4. **Attractant**.

The most appropriate measures for vector control

1. Mosquito control measures:

- Personal protection:
 - repellents (Diethyltoluamide, Dimethyl phthalate) – they are used mainly for application on the skin and their chief advantage is the short duration of protection;
 - protective clothing;
 - mosquito nets.
- Synthetic Insecticides: Pyrethrum extract (Pyrethrin); Malathion with ULV (ultra low volume); Chlorpyrifos and Abate are the most effective larvicides.
- Prevention of breeding – removal or destruction of breeding sites.

2. Lice control measures:

- Hygienic measures (personal hygiene):
 - clothing, towels and sheets should be washed in hot water and soap and pressed with hot iron;
 - autoclaving of clothes and bedding in steam sterilisers may be required for body louse control;
 - improving living standards.
- Insecticidal control (dust, shampoo, lotion) - Permethrin et al.

3. Fleas control measures:

- Individual self protection (repellents - diethyltoluamide, impregnated clothing with diethyltoluamide);
- Hygienic measures (house hygiene);
- Insecticidal control - Organo-phosphorus compounds and Synthetic pyrethroids;
- Integrated rat and flea control.

4. Tick control measures:

- Self protection – repellents, clothing, removal of attached tick, application of insecticides in houses;
- Community protection – area spraying with insecticides, vegetation management, treated with insecticides directed at the rodent reservoirs.

5. Cockroaches control measures:

- Cleanliness and hygiene, reduction of accessibility;
- Chemical control (area to be treated).

6. Housefly control measures:

- Improvement of environmental sanitation and hygiene;
- Reduction or elimination of fly breeding;
- Protection of food and people from contact with flies;
- Methods of killing flies directly:
 - physical – sticky tapes, light traps;
 - chemical – insecticide vaporizers, insecticide baits, spraying (Dichlorvos, Malathion);
- Health education.

DERATIZATION (RODENT CONTROL)

Rodent control is a complex of measures aiming to destruction of harmful rodents that are contagious diseases reservoirs. /de – destruction and “rattus” – rat/.

Types of rodent control - prophylactic and destructive.

Prophylactic rodent control:

- sanitary-hygiene measures;
- sanitary-technical measures

Methods of rodent control:

1. Biological
2. Physical (mechanical)
3. Chemical

1. **Biological means**

– natural rodent enemies – cats, dogs, hedgehogs, grass-snakes, storks, barn-owls. This is the ecological method.

– Hemosterilants:

- hormone patent medicine – contains estragon - the result is abortion and dead birth
- cadmium salts – they cause sperm necrosis in a few days. These substances in baits in natural conditions are not very tempting.

2. **Physical (mechanical) means**

- Traps – catching and killing. The carcass must be burnt and buried deeply in the earth. Gloves should be used.

3. **Chemical method** – this is the base of the contemporary rodent control. Rodenticides - from the Latin “Rodentia” – rodent. According to their mechanism of action and quickness of the toxic effect, they can be divided in two groups:

- **single-dose (acute) rodenticides,**

- **multiple-dose (cumulative) rodenticides – anticoagulants**

- **Acute rodenticides.** Symptoms appear in a few hours and are accompanied with unpleasant sensation. This leads to forming a conditioned “bait shyness” of the medicine, for example - zink phosphate, strychnine. They are also dangerous for secondary poisoning of domestic animals and people.

- **Multiple-dose (cumulative) rodenticides - anticoagulants.** The process of poisoning is slow and painless. Rodents develop anemia slowly and fatally due to massive hemorrhages. There isn't any conditioned reflex of “bait shyness”, but they have selective action. For reaching destructive effect rodents must have them in sublethal doses during some days and they cumulate.

- **First generation** anticoagulants – Ratsak, Racumin. “Saturation technique” – great quantities anticoagulants are necessary. They develop resistance.

- **Second generation** anticoagulants. “Pulse-technique” is used. The patent medicines are: Bromakii, Storm, Talon, Lanirat.

Route of application:

1. Food baits.
2. Paraffin blocks
3. Liquid baits
4. Contact baits
5. Gas rodenticides
6. With mechanical action

Forms with chemical means: powders, emulsions, microcapsule substances.

All rodenticides are dangerous and are applied by adequately trained persons. Regulation №1/05.01.2018 for DDD conditions and orders of application.