



University of Jordan
Faculty of Medicine



Medical Committee
The University of Jordan

Introduction to
Microbiology

Title :

Disinfection and sterilization

Professor:

Dr. Asem A-Shehabi

: 5

Slides

Handout

Sheet

Done by: **Ward Zeyad**



Price:

Designed by:
Wassem Kamal

M.D. Class of 2018

groups/Doctor2012
http://medstudygroup.weebly.com

By the name of God

Please refer to the slides while studying the sheet 😊

- **Disinfection** and **sterilization** (it's imp. To know the difference)
- Disinfection (ليس التعقيم وإنما التطهير): to reduce the human pathogens to a safe level. It reduces the vegetative form of bacteria; the spore forming bacteria are not affected.
- The “disinfection” term is used with inanimate subjects. Ex: surface of a table, towels.
- Whereas “**antiseptic process**” refers to: using a type of solution for disinfection process on living tissue.
- Sepsis: the presence of any organism in a sterile part of the body. Ex: in subcutaneous tissue, blood vessels.
- Antisepsis: to prevent the access of a foreign organism to a sterile part of the body.
- Sometimes the term disinfection is used referring to antiseptic process ... but this is not accurate.
- Sterilization is an absolute term: 100% , (sterile: free of all types of microorganisms including viruses)
- Disinfection is a relative term, not 100%
- Before the beginning of any surgery the number of microorganisms that normally exist in body flora must be reduced .ex: in case of having damage to skin, wound. Etc.... the surrounding area should be cleaned before doing the surgery or treatment.
- Normally our body is not free of pathogens, we have commensal bacteria which might enter the subcutaneous tissue.. might reach our lymph system.. and reach the blood stream.. and might cause infection. (despite the fact that these are commensal, not highly pathogenic. They can still produce local infections).

Normal body flora.. in the intestines and oral cavity (slides 3,4,5)

- Anaerobic bacteria (**obligate anaerobic**) form the majority of bacteria of the flora (95%), they're more abundant but less associated with infection, because they rarely get access to subcutaneous tissue and sterile parts of the body.
- (5%) is **facultative anaerobes**, this small fraction cause 90% of infections for both oral and intestinal cavity.
- Some of the bacteria of the body flora are beneficial and other might – under certain conditions- associate with infections.

Urogenital tract has two parts:

1. **Upper:** urinary bladder, ureter, kidneys... should be free of any type of microorganisms.
 2. **Lower:** urethra, vagina... have normal body flora.
- Urinary tract infection may be caused by ascending of bacteria from the lower part to the upper part.
 - Sterilization: procedure which reduce most immune pathogens.
 - Washing with water and soap is disinfectant process.
 - Any instrument that's going to be used in surgical procedure should be 100% sterile.
 - In developing countries... 5% of patients might be contaminated in hospitals during surgical procedures.

- If you want to treat a patient, you must not introduce any type of hospital acquired infection (nosocomial infection) to him

This is why care should be taken when dealing with patients. Patients in the hospital usually have a suppressed immune function.

❖ **Bacteriostatic:** inhibition of multiplication of the microorganism ... not killing.

❖ **Bactericidal:** killing infectants.

Antiseptic agents and disinfectant agents can't reach the level of bactericidal (kill 99%).

❖ **Microbiocidal:** killing all types of microorganisms

Some disinfectant solutions is a microbiocidal reagent.

- Some reagents can't be used on skin or in oral cavity because it might be toxic. Some of these solution are only to be used on inanimate objects
- According to the concentration of the antiseptic detergent it might be converted from bacteriostatic stage to bactericidal stage.
- Antibiotics at the recommended dose inhibit multiplication of organisms (for ex. 2 grams per day), immune system gets rid of the remaining inhibited form of the microorganism
- If the dose (concentration) is increased, the level of bactericidal might be reached, but this might be associated with pharmacokinetics and side effects. (this is done in some situations)

❖ **Refrigeration:** inhibit multiplication for limited time, but can't kill the microorganisms present in food... might kill cylinder type of pathogens.

To be cultured CFF sample is not refrigerated because the suspected bacteria like *Nisseria* might be killed.

❖ **Deep freezing:** a way of conservation of cytoplasmic DNA, has no effect on growth of bacteria, it preserves the bacteria.

❖ **Desiccation of food:** drying out of foot to get water out, mostly of fruit and vegetables (90% water), the remaining part is the solid material which won't support the multiplication of microorganisms.

• **Physical control of microbial growth-2 (slide 7) this is used in hospitals and pharmaceutical industries in order to obtain sterile products.**

✓ **Direct flaming** ... an oxidation process, the end products are CO_2 and certain minerals, kills all kinds of microorganisms.

- ✓ **Hot oven**... works by heating atmosphere, kills bacteria on the surface by oxidation process, very expensive, might cause damage to equipment used (like the disposable material), was used in laboratory and surgery.
- Hot water reaches the level of disinfection, doesn't reach the level of sterilization. You need to boil water for more than one hour to sterilize bacteria.
- Hot steam is used in a special device called "autoclave"... high pressure (3 bars= 15 PSI (pound square foot)... high temp.(121°C) under 3 bars, is used for all types of instruments, clothes, and gloves. It is an excellent process for sterilization. It can be used to sterilize almost any type of materials.
- Every hospital needs to have one or two large autoclaves.
- ✓ **Ionization radiation, Gamma ray**... highly effective by damaging the nucleotide of the bacterial cells, kill in few minutes (2-3 min.). This method is used to sterilized most of the disposable devices used in hospitals. It is widely used in pharmaceutical industries (sterilizing medications). In the past autoclaves were used.

- ✓ **Filtration** is used :

For pharmaceutical solutions or blood mainly in laboratory for researches. To prepare a solution for tissue culture. To prepare an antibiotic and filtering it from other drugs and powder. It is less used in clinical medicine.

- Pore size is important and depends on the filtered microorganism. Some membranes might be made out of cellulose or other materials. This depends on the size of the pore we need.

Use of gases

Alkylating gases: ethylene oxide gas, formaldehyde gas

- All gases that are used for sterilization are dangerous, must not be inhaled... they're toxic so they may affect the mucosa and result in death. So be careful to protect yourself and your colleagues.
- ✓ **Ethylene oxide:**
 - In short period ethylene oxide gas can interact with the cell wall and then the cell membrane of the microorganism and damage it which causes the death of microorganism.
 - It must be mixed with inert gas to reduce flammability.
 - It's an excellent gas for sterilization of some equipment in hospitals.
 - It is very toxic
 - Highly flammable
 - If inhaled it will produce damage for the lung tissue.
- Steps of sterilization of fiber endoscope (a surgical tool):

1. Washing with detergents and saline fluid.
 2. Exposure to ethylene oxide OR processing in autoclave.
- ✓ **Formaldehyde gas:** alkylates the cell wall by producing hydroxide which kills the microorganism, it's excellent for disinfection and sterilization.
 - For disinfection of surgery room after a treatment of a patient with HIV or a dangerous bacteria(... which cause...), formaldehyde is used for about 24 hours.
 - Formalin solution: formaldehyde dissolved in water (37%)
 - In case of studying damaged tissue of liver (deciding whether it's malignant or not) formalin is used to preserve the tissue biopsies.
 - A similar gas called ... aldehyde has similar usage, but formalin is more used. Formalin is used more for safety reasons.
 - Direct contact with these gases may cause allergic reaction and damage of the skin.

Chemical control of microbial growth (slides 12, 13)

Disinfection methods:

- For any surgical procedure even as simple as injection, the skin must be prepared at least with one disinfectant (alcohol or iodine)
 - The process of surgery requires two antiseptic reagents in order to have optimal antiseptic process (alcohol and iodine must be used)
1. Remove contaminants by physical means (water and soap)... this step helps to get the optimal effectiveness of the disinfectant.
 2. Disinfection.
- **Contact time:** the time of contact of the antiseptic agent and the skin... at least 2 min are recommended.

Cleaning the area u want to disinfect before applying the disinfectant increases the efficacy of the disinfectant.

Concerning water:

- Water should be treated with filtration and sedimentation methods to be free of the majority of microorganisms and other particles. Drinking water must be prepared with a disinfection process before it reaches the consumer.
- pH of water should be neutral.

Concerning milk:

- Usually fresh milk is prepared by pasteurization 63°C for 30 min. This process keeps most of organisms, so it can be drunk only in a short time (2 days) and must be kept in low temp.
- Long life milk is prepared by sterilization process