**Sterilization**

Sterilization: process of complete destruction of all microorganisms (pathogenic & non- pathogenic)

Methods of sterilization

Physical

Chemical

Heat

Radiation

Gamma Ray U.V Light

(gas)

Ethylene oxide

Chemical

Ethyl alcohol

H2O2 iodine formaldehyde

Moist heat

1- Boiling

2- saturated steam under pressure

Dry heat

1- hot air oven

2- direct flame

All instruments must be clean before being subjected to sterilization, this entails the removal of all foreign material particular attention is paid to serrations present on the jaw & catch & lock of hemostatic forceps & similar instruments, this should be done by soaking the soiled instruments in water to which has been added some detergent cleaner. Detergents assist in the removal of blood and tissue debris, making scouring & scrubbing of instruments unnecessary. following 10-15 minute immersion in the solution, instrument are rinsed & dried.

Methods of sterilization

Physical method by:

1. Heat
2. Dry heat: By using hot air oven which is usually used for glassware (flasks, tubes…) or by direct flame used for sterilization of the loop (used in microbiology).
3. Moist Heat
4. Boiling

Ancient, simple, economic, available method used in emergency cases where there is no other way for sterilization; by emerging instruments in water (Boling water) for 30 minutes but this method is not effective because spores cannot be destroyed by boiling. Also sharp instruments are ruined by this method (sharp edges become blunt), the instruments are contaminated during transportation (from the container to the table prepared for the surgical instruments).

Sterilization efficiency can be increased by adding 2% sod. Carbonate or 0.1% sod .hydroxide alkalinizing boiling water increases efficiency of sterilizations and reduces time needed for that from 30minutes to 15 minutes.

1. Saturated steam under pressure.

By using commercially available autoclaves of varying types and sizes offers a much more dependable method of sterilization.

Sterilization efficiency will not be optimal if the autoclave is improperly packed or loaded so that adequate circulation of steam is prevented. Use of color indicators is advocated to ensure that each batch of instruments and drops is stride at the time of its removal from the autoclave.

This method of sterilization also permits suitably prepared and enclosed surgical packs to be maintained in sterile storage for periods of up to 6 months, although a turn over every 3 weeks is advisable storage of sterile packs should be in adust free enclosure and not on an open shelf.

Transparent plastic tubing may be used for the steam sterilization of individual instruments. The required length is cut from a roll, one end is folded and stapled shut, the instrument is inserted and the other end is closed in the same manner.

1. radiation

use of ionizing radiation for sterilizing surgical gloves, sutures, syringes…

1. ethylene oxide

although ethylene oxide gas sterilization has been described as an inexpensive procedure, the high cost of the autoclave apparatus for this form of gas sterilization (which is sporicidal to a greater degree ).

1. Cold sterilization

Sterilization of instrument by chemicals it's not often effective for several reasons:

1. If the chemicals are used in the concentrations recommended they are bacteriostatic rather than germicidal.
2. Also most chemical are selective in their action destroying some organisms and only inhibiting the action of other organisms.
3. The action of some chemicals depends on exact concentrations and any deviation from this destroys their efficiency, any blood, pus, grease or tissue on the instruments will decrease their reliability.

For the chemical to be reliable the instruments must be free of all pus, blood, feces or anything that will prevent the germicide coming in contact with the metal.

1. To destroy spores it is necessary that the instrument remain in the solution for eighteen hours.
2. The chemical may be irritating to the tissues of some individuals so the formaldehyde should be all allowed to evaporate or be rinsed from the instruments.

\*Most reliable method for sterilization of surgical pack is by autoclave the one with the dryer (Temp, 121 °C, pressure 151 b/ inch2, time 30 minutes)([[1]](#footnote-1))

**Liquid chemical sterilization (cold sterilization)**

cold sterilization: refers to process of soaking instruments in a disinfectant (frequently Liquid) it has been practiced for centuries, still it's difficult to find perfect disinfectant.

* Difficult to find perfect disinfectant.
* When compared with thermal methods of sterilization it has decreased ability to access microbes. Most of chemicals do not have appropriate biologic activity.
* Because chemicals are irritant, some Have toxic effect these instruments sterilized by this method.
* Need to be rinsed in sterile water.
* Currently cold sterilization is not advised for surgical instruments. They are recommended for endoscopic, and laparoscopic equipment.

Among chemical used in cold sterilization

1. Glutaraldehyde

One of the most frequently used chemical, has good efficacy against bacterial spores but only with prolonged exposure it is acidic in aqueous solution and must be alkalinated to boost its efficiency.

Disadvantage of this chemical are its irritant for respiratory passages and can decrease pulmonary function&expensive.

1. Formalin
2. Is less efficient that glutaraldehyde.
3. Carcinogenic
4. Hydrogen peroxide
* Disinfectant act releasing hydroxyl free radical to interfere with cell membrane & nucleic acid..

Concentrations of 7.5% or greater exceed efficiency.

* it should be stored in dark containers to prevent loss of efficiency.
* It is toxic to mucous membrance.
* Can discolor some metals
1. Peracetic acid

Has good antimicrobial efficiency (oxidizing agent) relatively unstable, with short useful efficiency (6 days).

1. Quaternary ammoniums and hypochlorite's they are disinfectants not sterilant. But at certain concentrations may be antimicrobial with sterility generally are poor sterilizing agents.
2. Super oxidized water currently in some countries as sterilox.

**Steam sterilization**

Autoclave is most common method of sterilization in veterinary practice, used for heat and steam stable equipment (instruments).

* Kill microorganisms through coagulation and denaturation of proteins by moist heat.
* Inexpensive.
* Efficient (including against spores).
* Nontoxic, rapidly effective with different materials.

It's disadvantage is ruins sharp edged instruments.

* Flash sterilization

Refers to process of rapidly sterilizing used for items that are needed for immediate use. Using steam autoclave that is programed to use higher temperature 135°C with shorter time cycle 3 minutes and drying time 1 minute. Use for metallic non lumen items.

Gas sterilization

1. Ethylene oxide sterilization

Low temperature method (using ethylene oxide gas) it's colourless, odorless, boiling point 10.5°C act by alkylation of proteins and nucleic acid there by obstructing cell metabolism and reproduction. Used for items that cannot be steam sterilized. Eto is flammable so its mixed with CO2.

1. ozone sterilization

another method for sterilization of heat- sensitive items. Ozone is generated from oxygen and water during the sterilization cycle and then is converted back to those nontoxic compounds, O3 contains a loosely bound third oxygen molecule which readily oxidizes other molecules to cause destruction of microorganisms.

 Ozone sterilization is not suitable for wood and paper items or packaging.

Advantages has no toxic effects.

\* Plasma sterilization

Plasma sterilization use electromagnetic energy to create a plasma phase from a vapor of hydrogen peroxide, oxygen or peracetic acid / hydrogen peroxide mixture.

Plasma sterilization are rapid and effective but their high cost may be a concern.

Plasma sterilization is useful for heat sensitive items but should not be used for linens liquids or wood products.

Among advantages of plasma sterilization is short cycle time needed for sterilization, no toxic residue.

Sterilization by Radiation

Gamma irradiation is also used to sterilize surgical items because the units required are expensive and carry significant safety regulations their use is limited to manufacturing entities items such as suture, certain implants, surgical gloves.

1. [↑](#footnote-ref-1)