1.Chemotherapeutic agents

A.sulphonamides (BS)	sulphanilamide, sulphamethoxazole, sulphadimidine
B. Trimethoprim (BS)	
C. Sulphones(BS)	
D. Quinolones(BC)	naladixic acid, ciprofloxacin, norfloxacin, Enoxacin
E. Nitrofurans(BS)	furadantin
F. Nitroimidazoles(	metronidazole

2.Antibiotics

A. Beta lactams(BC)	penicillins, cephalosporins, carmbapenems, Monobactams
B. Aminoglycosides & Aminocyclitols (BC)	streptomycin, kenamycin, gentamicin, amicacin, tobramycin, netilmicin,sissomycin, spectinomycin

UNIVERSITY OF NAIROBI

SCHOOL OF MEDICINE

DEPARTMENT OF MICROBIOLOGY

Wednesday 5th May, 2010 **Prof. Ndinya Achola**

ANTIBIOTICS AND CHEMOTHERAPY

STERILIZATION AND DISINFECTION **Dr.Odhiambo**

These are procedures applied to eliminate completely or reduce the micro organisms from potential sources of infection, contaminated materials and surfaces

- Methods- physical or chemical , choice based on
  a) Material which the object is made of
  b) Intended use
  c) Available methods
- Aim is to protect workers against infection eg. Hospitals, operating theatres, clinics , microbiology laboratories etc.

STERILIZATION

The treatment or procedure which destroys all living microorganisms, bacteria,vegetative spores, fungi including fungal spores

- Results in destruction of all microbes
  (an item is either sterile or not there are no intermediates)
- Applied to instruments used in procedures that penetarate the skin eg. Injections, diagnostic aspirations

- In labs , during culture media preparation ,preparing reagents
- On specimens and cultures after handling in the laboratory

Methods used in sterilization are divided broadly in to 2 types

1. Physical methods a) heat
   b) filtration
   c) ionizing radiations
2. Chemical methods- use of sterilants

Heat

-used widely
-can be regulated by the user
-both dry heat and moist heat are used
-Temperature used is very important, determined by the nature of the material to be sterilized
-duration of exposure also matters, the greater the temperature the lesser the time taken
-degree of contamination of the object and the contaminants themselves (microorganisms)
-depends on whether the organisms form spores or not (those that form spores are harder to sterilize)
-cleaning reduces the number of bacteria before sterilization and should be applied where necessary

a) Dry heat

As a method of sterilization applied in form of

1.**Red heat**- Bunsen burner flame, metals only, spatulas, forceps etc

2.Flaming- a needle , a scalpel, passing it via the hottest part of a flame (gas or spirit falme), takes only a few seconds

3.Hot air oven

-used where large number of items are to be sterilized
-use an oven with a chamber and thermostat that regulates temperature, a fan to circulate the hot air

- Items can be wrapped using paper

Conditions for sterilization:- 160°c for 1hour, destroys most organisms and the spores
- 170°c for 40 minutes
-180°c for 20 minutes

Timing starts when all the items have reached the required temperature .Used for Glassware, scalpels, forceps etc.

4.**Infrared radiation**

-an electrically heated element that directs rays to items to be sterilized
-temps are as high as 180°c

b) Moist heat

- Involves the use of steam and water at different temperatures

- Kills microorganisms by by denaturing their proteins

1. Steam applied at temperatures above 100°c(steam sterilization)
   - 15lbs per sq .inch (100kpascals) at 121°c for 15 minutes
   - 30lbs per sq.inch (200k Pascal's) at 134°c for 3 minutes(reusable instruments)

2. At 100°c boiling
   - Steamer tindalyzation
   - Boiling ; reliable for inactivating pathogenic microbes

3. Temperature less than 100°c (pasteurization)
   - Heating at 63-66°c for 30 minutes
   - For milk primarily
   - Prevents decomposition of milk and milk borne infections

- Chemical test are used to determine the efficiency of the sterilization
  I. Browns indicator tubes- colour change occurs when exposed to required temperature for the required amount of time
  II. Bowie- dick test (tapes)
  III. Spore indicators
  Bacillus stercothermophillus spores
  Bacillus subtilis- for chemical sterilants

Filtration

- Removal of microorganisms from fluids
- Applied in heat labile substances eg. Serum, some vaccines etc.
- Filters of different pore sizes made of cellulose membranes

Ionizing radiations

- Gamma radiation (mainly) , electron beams from radioactive elements
- Damages chromosomal DNA of microorganism
- Not available locally, used on commercial basis for disposable items eg. Plastic syringes
- UV radiation
  - Radiation from the sun
  - Mercury vapour lamps are used
  - Rays are bactericidal and can destroy spores

Chemical methods

- STERILANTS
  - Fluids at given temperature, humidity and concentration
  - Examples include; ethylene oxide, glutaraldehyde, formaldehyde

- Their concentrations can be altered and used as disinfectants

1. Ethylene oxide- used at 55-60°c
   - for heat sensitive materials including fabrics, plastics and endoscopes
   - not common

2.Glutaraldehyde- used as 2% aqueous solution
   -for items that cannot withstand the autoclave
   -for items made of rubber and plastic
   -prolonged exposure can damage some instruments

4. Formaldehyde- fluid or gaseous form
   - highly effective to microorganisms and spores
   - used in the form of formalin , 40% solution of formaldehyde in water
   - wooden materials
   - main disadvantage is that it's an irritant

DISINFECTION

- ✓ Process of eliminating some or all of microorganisms from an article some of which might cause infection during its use
- ✓ The aim is to reduce chances of transmitting an infection, less precise compared to sterilization
- ✓ Useful when sterilization is not available
- ✓ Reduction of microbial contamination eg. Walls, floors etc.
- ✓ Washing of hands before surgical or invasive procedures
- ✓ Methods

1. washing
2. heat- washing or rinsing in hot water at 80-100°c for a short time
3. Chemical disinfectants
   - -classified into groups based on chemical composition
   - Their activities vary
   - Posses little selective toxicity
   - Used on inanimate environment and very limited extent on the skin, we use antiseptics, are relatively mild

MOA

I. Coagulation or denaturing of proteins; phenolates
II. Oxidation of essential molecules in cells eg. Sulphydryl groups of proteins to sulphoxides eg. Halogens, H_2O_2 , $KMnO_4$
III. Detergent like activity on cytoplasmic membranes; alcohols, ammonium compounds
IV. Interference with enzyme activity
V. Combination with nucleic acids of the microorganisms

Can be ineffective due to –over dilution

- Shortened exposure time
- Contact with organic material eg.pus
- Improper storage eg. exposure to light
- Prolonged storage after dilution for use

❖ Examples of classes of disinfectants

1) Phenolics- clearsol, dettol, Lysol 0.5-5% concentration
2) Halogens – hypochlorites;sodium hypochlorite (jik), calcium hypochlorite
   - iodine and iodophores(1% sol in 70% alcohol), used at a conc. of 1-10% dilution
3) alcohols – ethanol eg.used to disinfect skin at the injection site
4) chlorohexidine (hibitane) – disinfection of hands before invasive procedures can be combined with cetrimide to give savlon
5) quaternary ammonium compounds
6) Aldehydes (also sterilants)
   Include 2% glutaraldehyde
   10% formaldehyde
   - Effective in saturated steam at 40-80°c and 50 -60°c humidity