Infection control

Definition of infection:

- The invasion of bodily tissue by pathogenic microorganisms that proliferate, resulting in tissue injury that can progress to disease.

OBJECTIVES OF INFCTION CONTROL:-

- To protect the patient and members of the hospital team from contracting infections during hospital procedures
- To reduce the numbers of pathogenic micro-organisms in the dental operatory to the *lowest possible level.*
- To implement a high standard of infection control when treating *every patient* (universal precautions)

STRATEGY TO ACHIEVE INFECTION CONTROL:-

- All patients must be screened.
- Barriers for personal protection.
- Careful aseptic techniques.
- Sterilization & disinfection.
- Disposal of contaminated waste safely.

IMPORTANCE OF INFECTION CONTROL

- Prevents post procedure infections
- Results in high-quality, safe services
- Prevents infections in service providers and other staff
- Protects the community from infections that originate from health care facilities
- Prevents the spread of antibiotic-resistant microorganisms
- Lowers the costs of health care services, since prevention is cheaper than treatment.

Infection prevention:

- Infection prevention refers to policies and procedures used to minimize the risk of spreading infections, especially in hospitals and human or animal health care facilities.

Types of infection:

- **Primary infection:**

  Initial infection with an organism to host constitutes primary infection.

- **Secondary infection:**

  When in a host whose resistance is lowered by pre-existing infection, a new organism may set up a new infection.

- **Local infection:**

  Infection that is limited to a defined area or single organ with symptoms that resemble inflammation (redness, tenderness and swelling.)

- **Systemic infection:**

  Infection that spreads to whole body resulting in a septicemia.

- **Acute infection:**

  It appears suddenly or lasts for a short time. E.g. URI

- **Chronic infection:**

  May occur slowly over a long period and may last months to years.

- **Iatrogenic infection:**

  Infection resulting due to therapeutic and diagnostic procedures.

- **Nosocomial infection:**

Also known as **Hospital-acquired infection** (**HAI**) — is an infection that is contracted from the environment or staff of a healthcare facility. It can be spread in the hospital environment, nursing home environment, rehabilitation facility, clinic, or other clinical settings. Infection is spread to the susceptible patient in the clinical setting by a number of means. Health care staff can spread infection, in addition to contaminated equipment, bed linens, or air droplets. The infection can originate from the outside environment, another infected patient, staff that may be infected, or in some cases, the source of the infection cannot be determined.

Chain of infection:

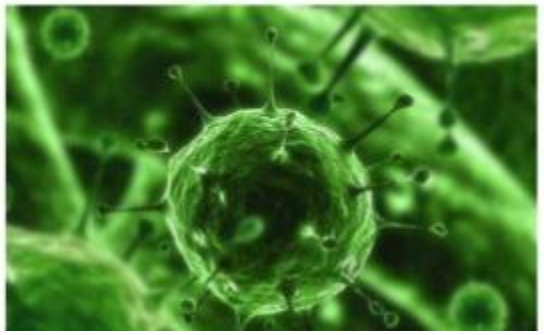
- The presence of a pathogen does not mean that an infection will begin. In order for infectious disease to spread, several necessary steps must occur. These steps are known as “chain of infection”. An infection will develop only if chain remains intact. These links are;


Causative Agent
Reservoir
Portal of Exit
Mode of Transmis sion
Portal of Entry
Susceptible Host

- **Causative Agent** - the microorganism (for example bacteria, virus or fungi).

- Bacteria

- Viruses

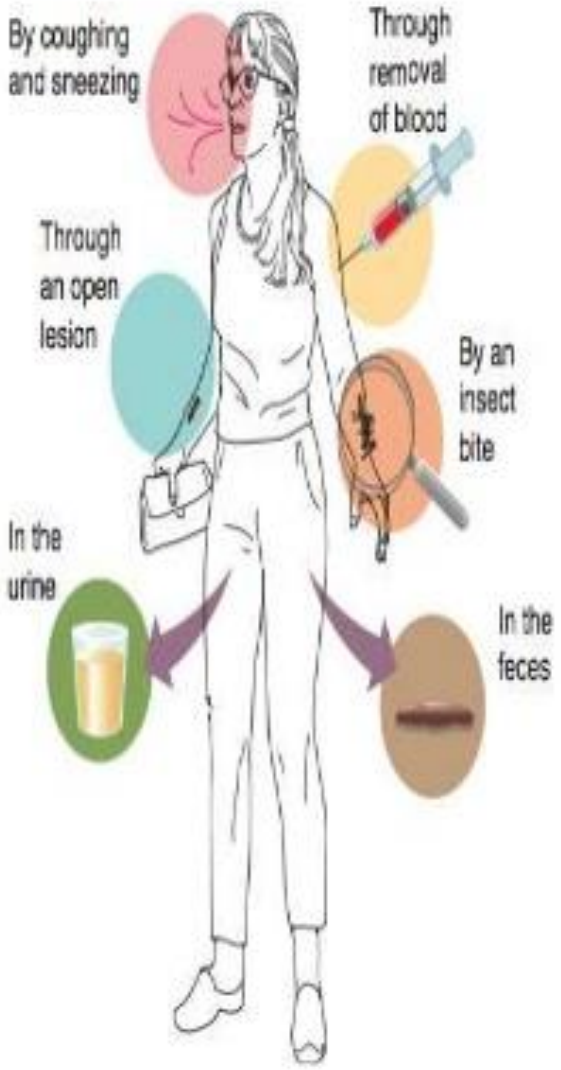


- Fungi

- Protozoa

- **Reservoir** (source) - a host which allows the microorganism to live, and possibly grow, and multiply. Humans, animals and the environment can all be reservoirs for microorganisms.

- **Portal of Exit** - a path for the microorganism to escape from the host. The blood, respiratory tract, skin and mucous membranes, genitourinary tract, gastrointestinal tract, and transplacental route from mother to her unborn infant are some examples.



- **Mode of Transmission** - since microorganisms cannot travel on their own; they require a vehicle to carry them to other people and places.

  Infectious diseases and even certain contagious diseases spread through the following agencies. Their ways of spreading is also given along with these agencies.

- Air-borne transmission
- Contact transmission-direct and indirect
- Vehicle transmission (Water, milk, food etc.)
- Vector-transmission
- Tran placental transmission

- **Portal of Entry** - a path for the microorganism to get into a new host, similar to the portal of exit.

- **Susceptible Host** - a person susceptible to the microorganism

Breaking chain of infection:

- As health professional, we cannot provide health care services without some exposure to potentially infectious materials, but we can prevent transmission in many cases. The only way to prevent infection is to break the chain of infection. The nurse must follow certain principle and procedures to prevent infection and control its spread.

Breaking the chain 1 of infection:

1. Rapid and accurate identification of organism:

- Routinely send blood cultures, urine culture, skin swabs, throat swabs, tracheal aspirate culture.
- Send endotracheal tube tip, urinary catheter tip and central line tip for culture after removal.

2. Control or elimination of infectious agents including:

- Proper cleaning by the water and mechanical action with or without detergents.

- Disinfection.
- Sterilization of contaminated objects.

❑ High level of disinfectants:

- Activated glutaraldehyde (cidex 2%)
- Sodium hypochloride 1%
- Carbolic solution 5%
- Bleaching powder 1%

❑ Low level of disinfectant:

- Methylated spirit 70%
- Betadine solution 10%
- Savlone 1%

Breaking the chain 2 of infection:

- Measures to control or eliminate of reservoir of infection.
- **Employee health:**
- Immunization of health personnel's e.g. hepatitis B vaccine
- Regular checkup for early detection of any communicable disease
- Restriction from work of patient contact when infected with communicable disease.
-

❑ Environmental disease:

- Cleaning with hospital approved clear disinfectant, e.g. phenol
- Through cleaning of bed and bedside equipments before admitting new patient.
- Separate mops should be used for cleaning of unit. (Twice a day).
- Damp dusting should be done.
- Drains should be patent.

❑ Handling of linen:

- Keep bed sheets dry and clean.
- Change sheets every day.
- Do not shake blankets and linen.
- Do not throw them on floor.
- Soiled linen counting should be done in separate place.

❑Pest control:

- Measures to be taken to avoid their entry into unit. E.g. proper cleaning, sealing and draining.
- Patient's diet should be kept in covered containers.
- Keep fly trappers on each bedside of patient.
- Pesticide spray should be used weekly.

- **Visitors control:**
- Traffic should be restricted except for doctor, nurse and supportive staff.
- Allow only one attendant (3-4 hours).
- Keep the doors and windows closed.
- Mobile phones should not be allowed inside the area.
- Machines (X-rays, echo machines, ultrasound machine) from outside should be cleaned with spirit before their use.

Breaking the chain 3 of infection:

- **Portal of exit:**
  - Practice aseptic precaution.
  - Avoid talking directly into the client's mouth to prevent the droplet infection.
  - Wearing of mask is compulsory if the nurse is infected or she is dealing with the patients who are infected.
  - Careful handling of waste like urine, faeces, emesis and blood is important.
  - Disposable gloves should be worn to prevent direct contact with wastes or infected materials.

Breaking the chain 4 of infection:

Mode of transmission:

- **Contact Precautions;**

- Single patient room.
- Staff to perform hand hygiene, put on gown/apron and gloves prior to entering patient room and when anticipating contact with the patient or their surroundings is.
- Remove gown/apron and gloves and perform hand hygiene after leaving room.
- Clean and disinfect non-disposable equipment and items when removed from patient room.

- **Droplet Precautions;**

- Single patient room.
- Staff to put on surgical mask when entering room and remove and dispose of mask after leaving room and perform hand hygiene.
- Instruct patient about respiratory hygiene and cough etiquette.
- Limit patient movement outside the room to medically-necessary purposes.
- Patient to put on a surgical mask when leaving room.

❑ Airborne Precautions;

- Single negatively pressured room.
- Door to remain closed.
- Staff to put on N95/P2 mask when entering patient room and remove and dispose of mask and perform hand hygiene after leaving room.
- Instruct patient about respiratory hygiene and cough etiquette.
- Patient to put on surgical mask when leaving room.

Breaking the chain 5 of infection:

- **Portal of entry:**
  - Maintain integrity of skin and mucous membrane.
  - Prepare position of tubing, etc. may prevent injuries and skin breakdown.
  - Turning and positioning of debilitated clients.

- Ensure the personal hygiene of client regularly.
- Proper disposal of contaminated syringe and needles.
- Proper handling of catheters and drainage set etc. care should be taken while collecting and handling specimen.

Breaking the chain 6 of infection:

❑Protecting susceptible host:

- Protecting the normal defense mechanism by,
- Regular oral hygiene.
- Maintaining adequate intake.
- Encouraging deep breathing exercise.
- Encouraging proper immunization of children and adult client.

❑Maintaining healing process:

- Promotion of intake of well-balanced diet containing essential protein, vitamins, fats and carbohydrates.
- Institution measures to improve appetite of patient.
- Helping the client to identify methods to relieve stress.

Defense Mechanisms

- A number of defense mechanisms exist outside and in the body to break the chain, including decreasing the sources of microorganisms; preventing the transmission of microorganisms; and maximizing the host's resistance to the microorganism

Body's natural defenses to eliminate/kill pathogens

- Cilia - in respiratory tract, catch and move pathogens out of the body
- Coughing/sneezing, to propel pathogens outward
- Tears - contain chemicals to kill bacteria
- Hydrochloric acid in stomach
- Rise in body temperature (fever)
- Leukocyte (white blood cell) production increases, to destroy pathogens

Regulatory Agencies

- Center for Disease Control and Prevention (CDC) - Responsible for developing safe guidelines to help prevent and control the spread of infectious diseases
- Occupational Safety and Health Administration (OSHA) - Responsible for maintaining minimum health and safety standards for employees

Prevention: Medical Asepsis

- Medical asepsis (clean technique): procedures to decrease the number and spread of pathogens
- Hand washing, good personal hygiene, cleaning rooms between patient use, proper disposal of gloves after contact with body fluids or contaminated objects

Prevention: Surgical Asepsis

- Surgical asepsis (sterile technique): procedures that completely eliminate the presence of pathogens from objects and areas
  - Sterile caps, gowns, masks, and gloves
  - Sterilizing instruments
  - Maintaining sterile fields
  - Changing dressing
  - Disposing of contaminated materials

STANDARD SAFETY MEASURES OR STANDARD PRECAUTION OR PERSONAL PROTECTIVE EQUIPMENTS (PPE):

Introduction:

- **Universal precautions** refers to the practice, in medicine of avoiding contact with patients' bodily fluids, by means of the wearing of nonporous articles such as medical gloves, goggles, and face shields. The practice was introduced in 1985–88. In 1987, the practice of universal precautions was adjusted by a set of rules known as body substance isolation. In 1996, both practices were replaced by the latest approach known as standard precautions.

Precaution related to body fluids

- Universal precaution apply to:
- Blood
- Semen
- Vaginal secretions
- CSF
- Pleural/peritoneal/pericardial/amniotic fluids

- Universal precaution does not apply:

1. Feaces
2. Nasal secretions
3. Sputum
4. Sweat
5. Tears/urine/vomitus
6. saliva

- Pathogens fall into two broad categories, blood borne (carried in the body fluids) and airborne.
- Standard precaution contains following things;
- Hand washing
- Gloving
- Gowning
- Mask/ protective eye wear/ cap
- Shoe cover

Standard Precautions

- Developed by the CDC
- Follow at all times and apply to every patient
- To prevent contact with potentially infectious body fluids: blood, secretions, excretions, non-intact skin and mucous membranes

Definition:

- Standard precaution is defined as, “a set of precautionary measures including good hand hygiene practices and use of protective barriers during routine patient care carried out by health care workers (HCW)”.

Hand washing:

- Hand washing or hand hygiene is the act of cleaning one's hands with or without the use of water or another liquid, or with the use of soap for the purpose of removing soil, dirt, and/or microorganisms.

Your 5 Moments for Hand Hygiene

Steps of hand washing:

Step-1

Rub palms together

Step-2

Rub the back of both hands

Step-3

Interface fingers and rub the hands together.

Step-4

Interlock fingers and rub the back of fingers of both hands

Step-5

Rub thumb in a rotating manner followed by the area between index finger & thumb.

Step-6

Rub fingertips on palm for both hands

Step-7

Rub both wrists in a rotating manner rinse and dry thoroughly.

Masks:

- When mask is correctly applied, it will fit snugly and securely over the nose and mouth.
- To protect staff from inhalation of infectious aerosols or droplets, smoke or plume or other airborne hazards.
- To prevent the spread of micro-organisms from the nasopharynx of staff of the patient to others who are susceptible.

❑Types of masks:

- **Surgical Mask:** Used in wards, departments or operating theatres.

- **N95 Particulate Mask:** Used when caring for patients with diagnosed or suspected airborne infectious diseases.

Gloving:

- Gloves must be available and accessible in a range of sizes in all patient care areas.
- Wearing gloves reduces contamination of hands and minimizes the risk that a health care worker will become infected after contact with a patient's blood or body substance. Wearing gloves reduces the likelihood that staff will transmit micro-organisms for their hands to patients.

- **The type of glove used will depend on the task involved:**
  - **Non sterile gloves:** Non sterile nitrile gloves are suitable for most situations when contact with any blood or body substance, mucous membranes or non-intact skin is anticipated.
  - **Sterile gloves:** Sterile latex gloves shall be worn for surgical procedures where asepsis must be maintained. Staff involved with surgical procedures should double-glove for added protection

Eye/ Face Protection:

- Eye/face protection shall be worn in any situation when splash or splatter with blood or body substance to the mucous membrane of the mouth, nose and or eyes in likely.

Types of eye/face protection:

- Chin length plastic face shield

- Goggles Note

Types of protective clothing:

- **Plastic aprons:** In general, disposable plastic aprons are sufficient to provide protection from contamination
- **Fluid Resistant Gown:** Long sleeved, disposable fluid resistant gowns should be used for contact isolation or where there is an elevated risk of contamination

❑Prevention of injuries from sharps:

- Use the “handles-free” techniques when passing sharps during clinical procedures.
- Do not bend, break, or cut hypodermic needle before disposal.
- Do not recap the needles.
- Disposal of hypodermic needles and other sharps properly.

❑Safe-passing of sharp instruments:

- Uncapped or otherwise unprotected sharps should never be passed directly from one person to another. In the operating theater or procedure room, pass sharps instruments in such a way that the surgeon and assistant are never touching the item at the same time. This way of passing sharps is known as the "hands-free" techniques:

- The assistant places the instrument in a sterile kidney basin or in designated “safe zone” in sterile field.
- The service provider picks up the instrument, uses it, and returns it to the basin or safe.

❑Managing injuries and exposure:

- Studies have shown that cleaning a wound with an antiseptic or squeezing it does not reduce the risk of infection. If you are accidently exposed to blood or other body fluids, either by needle stick, an injury from another sharp object, and a splash of fluid:
- Wash the needle stick injury site or cut with soap and running water.
- Flush splashes to the nose, mouth or skin with water.
- Irrigate splashes to the eyes with water or saline.

❑Post exposure prophylaxis:

- Post exposure prophylaxis with drugs or other therapy can reduce the risk of transmission of some blood borne pathogens.
- **For hepatitis B:** hepatitis B immune globulin and hepatitis B vaccine can reduce the risk of infection after exposure to blood or other body fluids containing the hepatitis B virus.
- **For hepatitis C:** there is no post exposure prophylaxis available for hepatitis C. Neither immune globulin nor antiviral drugs shown to reduce the risk of hepatitis C transmission.

❑Safe disposal of sharps:

- Do not recap, bend or break needle before disposal, and do not remove the needle from the syringe by hand.
- Dispose of needles and syringe immediately after use in a puncture resistant sharp disposal container.

❑Sharps disposal containers:

- Puncture resistant sharp disposal containers should be conveniently located in any area where sharp objects are frequently used (such as injection rooms, treatment room, operating theater, labor and laboratories.)

Spaulding's classification of medical devices

Clinical device	Definition	Example	Infectious risk	Reprocessing procedure
Critical device	Medical device that is intended to enter a normally sterile environment, sterile tissue or the vasculature	Surgical instruments	High	Sterilization by steam, plasma, ethylene oxide gas
Semi-critical device	Medical device that is intended to come in contact with mucous membrane or minor skin breaches	Flexible endoscope	High, intermediate	Sterilization desirable; high level disinfection
Non-critical device	Medical device that come in contact with intact skin	BP cuff, thermometer	Low	Low level Disinfection

Decontamination, Sterilization, Disinfection

Decontamination

- Decontamination of medical equipment involves the destruction or removal of any organisms present in order to prevent them infecting other patients or hospital staff.

14 gm≈ 3 tea spoon Bleaching Powder/lt

1 part Sodium Hypochloride to 4 parts of water

Disinfectants

- Chemical disinfectants can be harmful to the skin. When using chemical disinfectants follow manufacturer's directions for dilution and for antidoting any exposure
- 10% household bleach in water meets OSHA requirements, kills HBV, HIV and TB
- Soaking for 20-30 minutes in 70% isopropyl alcohol acts as a disinfectant: used for some instruments, glass thermometers
- Boiling instruments in water: cover and boil in "boiling water" for 20 mins. Rarely used today.

Common disinfectants used for environmental cleaning in hospitals

Disinfectants	Recommended Use	Precautions
Sodium Hypochloride	Decontamination of material contaminated with blood and body fluids	- Should be used in well ventilated areas. -Protective clothing required while handling and using undiluted. - Do not mix with strong acids to avoid release of chlorine gas. - Corrosive to metals
Bleaching Powder	Toilet/ bathrooms	Same as Sodium Hypochloride

Alcohol (70%): Ethyl Alcohol, Methylated spirit	**Smooth Metal Surfaces tabletops and other surfaces where bleach can not be used**	**- Flammable, toxic, to be used in well ventilated area, avoid inhalation.** **- Keep away from heat source, electrical equipment, flames, hot surfaces.** **- allow it to dry completely, particularly when using diathermy as it can cause diathermy burn.**
Carbolic Acid (Phenol)	Floor mopping, cleaning OT room, Contaminated bed, furniture etc	- toxic
Phenyle, Lysol	Black Phenyle is used in cleaning toilet and bathroom. White phenyl is used in routine	- Poisonous

Preparing Household Bleach as a Disinfectant Household Bleach is 5.25% sodium hypochlorite solution (50,000 ppm)			
Level Required	**What For**	**How to make**	**Contact time**
1:10 Dilution (1 part bleach in 9 parts water) 5000 ppm	Large blood spill (after surface cleaning)	25 ml bleach in 225 ml water Same as 5 tsp bleach in 1 cup water	20 minutes
1:50 Dilution (1 part bleach in 49 parts water) 1000ppm	Surface cleaning	10 ml bleach in 490 ml water Same as 2 tsp bleach in 2 cups water	10 minutes
1:100 Dilution (1 part bleach in 99 parts water) 500ppm	Minor blood spill	5ml bleach in 495 ml water Same as 1 tsp bleach in 2 cups water	10 minutes

Preparation of 2% Carbolic Acid solution

Carbolic Acid (Phenol)	Available concentration = 100%	To make 2% solution add 20 ml of carbolic acid in 980 ml of water (aprrox.1 litre)

Sterilization

- Chemical agents and physical methods used to destroy or inhibit growth of pathogens
- Bacteriostatic – inhibits growth
- Bacteriocidal/germicidal – kills microorganisms
- Antiseptics – bacteriostatic chemical agents, mild enough to use on skin: 70% isopropyl alcohol
- Disinfectants – destroy most bacteria and viruses. Used for instruments that do not penetrate the skin and for cleaning the environment – floors, bathrooms, equipment

Sterilization

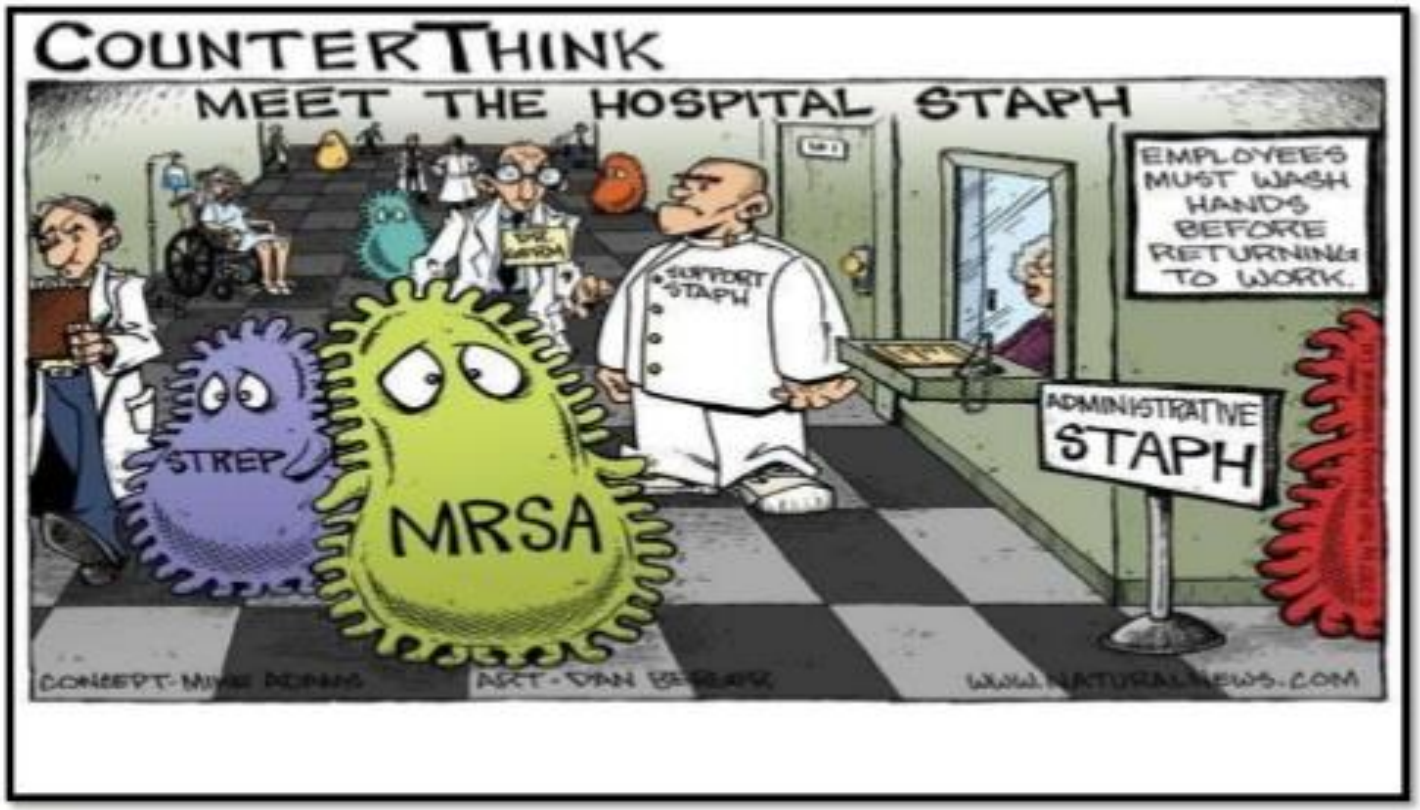
- Agents/methods that totally destroy all microorganisms including viruses and spores
- Include chemical agents, gas, radiation, dry or moist heat under pressure
- Most common method used is the autoclave, which sterilizes by steam created by a pressurized heating system
- Small units used in a medical office; large units used in hospitals

Sterilization

- Sterilization is the destruction of all micro-organisms.

1. Autoclave (Steam Under Pressure)
2. Flamming
3. Chemical Sterilization
   i. Glutaraldehyde
   ii. Alcohol
   iii. Formalin
4. Gas Sterlization
   i. Ethylene Oxide
5. Iradiation

NOSOCOMIAL INFECTIONS



Introduction:

- Clients in health care setting may have an increased risk of acquiring infection. HAI results from delivery of health services in the health care facility. A hospital is one of the most likely places for acquiring infection because it harbors a high population of virulent strains of micro-organism that may be resistant to antibiotics. The intensive care unit is one area in the hospital where that risks of acquiring a HAI is especially high.

Definition:

- A hospital-acquired infection is usually one that first appears three days after a patient is admitted to a hospital or other health care facility. Infections acquired in a hospital are also called Nosocomial infections.

- **For a HAI, the infection must occur:**
- Up to 48 hours after hospital admission.
- Up to 3 days after discharge.
- Up to 30 days after an operation.
- In a healthcare facility when someone was admitted for reasons other than the infection.

Sites and cause of HAI:

- Urinary tract:
- Surgical and traumatic wounds:
- Respiratory infection:
- Blood stream:

Nursing process in infection control

1. Assessment:

- **Inadequate primary defense:** broken skin or mucosa, traumatized tissues, use ciliary action, obstructed out flow, altered peristalsis and reduce mobility.
- **Inadequate secondary defense**: reduced Hb level, suppression of WBC, suppressed inflammatory response.

Client's susceptibility:

- **Age:**

- An infant has immature defense against infection.
- The young middle age adult has refined defense against infection..
- Defense against infection may changes with aging. The immune response, particularly cell mediated immunity declines.

Nutritional status:

- Reduction in intake of proteins and other nutrients such as carbohydrates and fats reduces the body's defense against infection and Impairs wound healing

- **Stress:**
- The body response to emotional or physical stress by general adaptation syndrome, if stress continued or become intense, then elevated cortisone level result in used resistance to infection

Hereditary:

- Certain hereditary conditions impair an individual's response to infection.
- For example gammaglobuinemia is rare inherited or acquired characterized by absence of serum

Disease process:

- Client with disease of immune system are of particular risk for infection. Leukemia, AIDS, lymphoma and aplastic anemia are conditions that compromise a host by weakening defenses against infectious organisms.
- Burn client have a very high susceptibility to infection because of damage to skin surface.

- **Medical therapy:**
- Some drugs and medical therapies compromise immunity to infection.
- **Cyclosporine** and other **immunosuppressant drugs**, clients receiving **radiotherapy and chemotherapy** are also risk for infection.

2. **Nursing diagnosis:**

The following are example of nursing diagnosis that may apply;

- Disturbed body image
- Risk of infection
- Risk for injury
- Imbalanced nutrition less than body requirements
- Risk for impaired skin integrity
- Impaired tissue integrity

3. Planning:

- Preventing exposure to infectious organism.
- Controlling or reducing the extent of infection.
- Maintaining resistance to infection.

4. Implementation:

Through practical thinking the nurse may prevent infection from developing, spreading by minimizing the numbers and kinds of organism transmitted to potential sites.

5. Evaluation:

- To evaluate whether your client has achieved the expect outcome and has remained free of infection.
- Maintain high standard of medical and surgical asepsis and constantly monitor the client for sign in infection.

HOSPITAL/ BIO MEDICAL WASTE

Introduction:

- Hospital or health care waste is generally named and popular as Bio Medical Waste.

- According to bio-medical waste management and handling rule 1998 of India:

  Bio-medical waste means any waste which is generated during the diagnosis, treatment or immunization of human being o animals or in research activities.

Sources of Bio-Medical Waste

Major Sources

- ❑ Hospitals
- ❑ Labs
- ❑ Research centers
- ❑ Animal research
- ❑ Blood banks
- ❑ Nursing homes
- ❑ Mortuaries
- ❑ Autopsy centers

Minor sources

- Clinics
- Dental clinics
- Home care
- Cosmetic clinics
- Paramedics
- Funeral services
- Institutions

Types of waste

- **Infectious waste:** waste contaminated with blood and other bodily fluids (e.g. from discarded diagnostic samples),cultures and stocks of infectious agents from laboratory work (e.g. waste from autopsies and infected animals from laboratories), or waste from patients with infections (e.g. swabs, bandages and disposable medical devices);
- **Pathological waste:** human tissues, organs or fluids, body parts and contaminated animal carcasses;
- **Sharps waste:** syringes, needles, disposable scalpels and blades, etc.;
- **Chemical waste:** for example solvents and reagents used for laboratory preparations, disinfectants, sterilants and heavy metals contained in medical devices (e.g. mercury in broken thermometers) and batteries;
- **Pharmaceutical waste:** expired, unused and contaminated drugs and vaccines;
- **Cyctotoxic waste:** waste containing substances with genotoxic properties (i.e. highly hazardous substances that are, mutagenic, teratogenic or carcinogenic), such as cytotoxic drugs used in cancer treatment and their metabolites;
- **Radioactive waste:** such as products contaminated by radionuclides including radioactive diagnostic material or radiotherapeutic materials; and
- **Non-hazardous or general waste:** waste that does not pose any particular biological, chemical, radioactive or physical hazard.

Health Risks!

- sharps-inflicted injuries (Hep B, Hep C, HIV);
- toxic exposure to pharmaceutical products, in particular, antibiotics and cytotoxic drugs released into the surrounding environment, and to substances such as mercury or dioxins, during the handling or incineration of health care wastes;
- chemical burns arising in the context of disinfection, sterilization or waste treatment activities;
- air pollution arising as a result of the release of particulate matter during medical waste incineration;
- thermal injuries occurring in conjunction with open burning and the operation of medical waste incinerators; and
- radiation burns.

Environmental impact!

- untreated health care wastes in landfills can lead to the contamination of drinking, surface, and ground waters if those landfills are not properly constructed.
- The treatment of health care wastes with chemical disinfectants can result in the release of chemical substances into the environment if those substances are not handled, stored and disposed in an environmentally sound manner.
- Incineration of waste has been widely practiced, but inadequate incineration or the incineration of unsuitable materials results in the release of pollutants into the air and in the generation of ash residue. Incinerated materials containing or treated with chlorine can generate dioxins and furans, which are human carcinogens and have been associated with a range of adverse health effects. Incineration of heavy metals or materials with high metal content (in particular lead, mercury and cadmium) can lead to the spread of toxic metals in the environment.
- Only modern incinerators operating at 850-1100 °C and fitted with special gas-cleaning equipment are able to comply with the international emission standards for dioxins and furans.
- Alternatives to incineration such as autoclaving, microwaving, steam treatment integrated with internal mixing, which minimize the formation and release of chemicals or hazardous emissions should be given consideration in settings where there are sufficient resources to operate and maintain such systems and dispose of the treated waste.

Biomedical waste management and handling rules, 2016

GOVERNMENT OF INDIAMINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Yellow	(a) Human Anatomical Waste:Human tissues, organs, body parts and fetus below the viability period (as per the Medical Termination of PregnancyAct 1971, amended from time to time). (b) Animal Anatomical Waste :Experimental animal carcasses, body parts, organs, tissues, including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses.	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial*

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
	(c) Soiled Waste:Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.		Incineration or Plasma Pyrolysis or deep burial* In absence of above facilities, autoclaving or micro-waving/hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
	(d) Expired or Discarded Medicines:Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc	Yellow coloured non-chlorinated plastic bags or containers	Expired `cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200 0C or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >12000C Or Encapsulation or Plasma Pyrolysis at >12000C.All other discarded medicines shall be either sent back to manufacturer or disposed by incineration

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
	e) Chemical Waste:Chemicals used in production of biological and used or discarded disinfectants	Yellow coloured containers or non-chlorinated plastic bags	Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility
	(f) Chemical Liquid Waste :Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids,liquid from laboratories and floor washings, cleaning, house-keeping and disinfecting activitiesetc	Separate collection system leading to effluent treatment system	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with other wastewater

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
	(g)Discarded linen, mattresses, beddings contaminated with blood or body fluid.	Non-chlorinated yellow plastic bags or suitable packing materia	Non-chlorinated chemical disinfection followed by incineration or Plazma Pyrolysis or for energy recovery.In absence of above facilities, shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery or incineration or Plazma Pyrolysis.

Plasma pyrolysis is a state-of-the-art technology for safe disposal of medical waste. ... In the **plasma pyrolysis** process, the hot gases are quenched (rapid cooling) from 500° to 70°C to avoid recombination reactions of gaseous molecules that inhibit the formation of dioxins and furans

Encapsulation is a **waste disposal** method that packs **hazardous** materials in containers made of impervious (not allowing fluid to pass through) and non-reactive material. The containers are sealed with concrete, plastic, or steel for burial or storage

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
	(h) Microbiology, Biotechnology and other clinical laboratory waste:Blood bags, Laboratory cultures, stocks or specimens of micro-organisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures	Autoclave safe plastic bags or containers	Pre-treat to sterilize with non-chlorinated chemicals on-site as per National AIDS Control Organisation or World Health Organisation guidelines thereafter for Incineration

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Red	Contaminated Waste (Recyclable)(a) Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and vaccutainers with their needles cut) and gloves	Red coloured non-chlorinated plastic bags or containers	Autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible. Plastic waste should not be sent to landfill sites

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
White (Translucent)	Waste sharps including Metals:Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps	Puncture proof, Leak proof, tamper proof containers	Autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Boards or Pollution Control Committees) or sanitary landfill or designated concrete waste sharp pit.

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Blue	(a)Glassware:Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes	Cardboard boxes withblue colored marking	Disinfection (by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment) or through autoclaving or microwaving or hydroclaving and then sent for recycling.
	b)Metallic Body Implants	Cardboard boxes with blue colored marking	

New 8 Categories of BMW

CATEGORY	TYPE OF WASTE	TREATMENT & DISPOSAL
Category 1	Human anatomical wastes	Incineration/ deep burial
Category 2	Animal wastes	Incineration/ deep burial
Category 3	Microbiology & biotechnology waste, **Liquid wastes, waste from Laboratory, blood banks, hospitals, house etc.**	Local autoclaving/ microwaving/ incineration/ **Disinfection by chemicals**
Category 4	Waste sharps like needles, syringes, scalpels, blades, glass etc	Disinfection (Chemical/autoclaving/ micro waving & mutilation/shredding)
Category 5	Discarded Medicines & cytotoxic drugs	Incineration/ destruction & disposal in land fills

CATEGORY	TYPE OF WASTE	TREATMENT & DISPOSAL
Category 6	Soiled wastes Items contaminated with blood, body fluids including cotton, dressings etc	Incineration, autoclaving, microwaving
Category 7	Solid wastes like catheters, IV sets etc.	Disinfection by chemical treatment/autoclaving /micro waving and mutilation & shredding
Category 8	Chemical wastes	Chemical treatment & discharge into drains for liquid and secured land fills for solids.

New colour coding

Colour Coding	Type of container to be used	Waste Category Number	Treatment
 Yellow	Non Chlorinated plastic bags	Category 1,2,5,6	Incineration
 Red	Non Chlorinated plastic bags/puncture proof container for sharps	Category 3,4,7	Disinfection, autoclave, microwave, mutilation & shredding, landfilling
 Blue	Non Chlorinated plastic bags container	Category 8	
 Black	Non Chlorinated plastic bags	Municipal Waste	

Category	Waste Category (Type)	Treatment and Disposal Option
Category No. 1	**Human Anatomical Waste** (human tissues, organs, body parts)	Incineration [@@@]
Category No. 2	**Animal Waste** (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals/colleges, discharge from hospitals, animal houses)	Incineration [@@]
Category No 3	**Microbiology & Biotechnology Waste and other laboratory waste** (wastes from clinical samples, pathology, bio-chemistry, haematology, blood bank, laboratory cultures, stocks or specimens of micro- organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biological, toxins, dishes and devices used for transfer of cultures)	Disinfection at source by chemical treatment[@] or by Autoclaving /microwaving followed by mutilation /shredding[##] and after treatment final disposal in secured landfill or disposal of recyclable wastes (plastics or glass) through registered or authorized recyclers.
Category No.4	**Waste sharps** (needles, glass syringes or syringes with fixed needles, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection by chemical treatment[@] or Destruction by needle and tip cutters, autoclaving or microwaving followed by mutilation or shredding[##], whichever is applicable and final disposal though authorized CBWTF or disposal in secured landfill or designated concrete waste sharp pit.

Category No.5	**Discarded Medicines and Cytotoxic drugs** (wastes comprising of outdated, contaminated and discarded medicines)	Disposal in secured land fill or Incineration [@@@]
Category No.6	**Soiled Waste** (Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, linen, beddings, other material contaminated with blood)	Incineration [@@@]
Category No.7	**Infectious Solid Waste** (Wastes generated from disposable items other than the waste sharps such as tubings, hand gloves, saline bottles with IV tubes, catheters, glass, intravenous sets etc).	Disinfection by chemical treatment [@] or Autoclaving or Microwaving followed by mutilation or shredding [##] and after treatment final disposal through registered or authorized recyclers
Category No. 8	**Chemical Waste** (Chemicals used in production of biologicals, chemicals used in disinfection, as insecticides etc.)	Chemical treatment [@] and discharge into drains meeting the norms notified under these rules and solids disposal in secured landfill

Disposal of biomedical waste includes three stages:

- Collection and segregation
- Transportation and storage
- Disposal techniques

DISPOSAL TECHNIQUES:

1. Chemical disinfection:

- Solid waste must be disinfected before they are sent for final disposal. Chemical disinfection is most appropriate method for to treat the liquid waste such as blood, urine, and stool or hospital sewage.

2. Thermal measures:

- **Autoclave (wet thermal treatment):**
  It is effective method of sterilization for microbiology and biotechnology waste.

- **Hydroclave(dry thermal treatment):**
  In this method shredded infectious waste is exposed to high temperature, high pressure steam like autoclaving. **It dries 80% liquid of waste and waste is reduced to 20-30% in weight.** Adequately trained operators or technicians are needed for its operation.

3. Microwave irradiation:

- This technique is also effective like autoclave in sterilizing infected disposable waste. Most of micro-organism destroyed by action of microwaves.

4. Incineration:

- It is a high temperature dry oxidation process that reduces organic, incombustible matter. It also reduces the volume and weight of waste.

5. Inertization:

- In this process cement and other substance are mixed with waste before disposal. Mixing of cement etc. reduces risk of migrating toxic substance into surface water or ground water. After making homogeneous mixture, cubes are prepared at site, and then transported to final disposable site.

6. Landfill:

- It is quite effective, provided practiced appropriately a sanitary landfill observing certain rues can be acceptable choice for disposal of biomedical waste, particularly in develop

Hospital Infection control Program

Hospital infection control program can help healthcare organizations monitor and improve practices, identify risks and proactively establish policies to prevent the spread of infections

Components of infection control programme

1. Basic measure for infection control-standard and additional precaution
2. Education and training of health care workers.
3. Protection of health care workers
4. Identification of hazards and minimizing risks.
5. Aseptic techniques
6. Use of single use device, reproccessing of instrumental and equipment

7. Antibiotic usage,management of body/blood fluid,exposure handling of blood/blood product and hospital waste management.
8. Surveillance
9. Outbreak investigation
10. Incident monitoring

OBJECTIVES

- The main objectives of these guidelines is to prevent the health care workers and the environment from the transmission of infections:
- Facilities, equipment, and procedures necessary to implement standard precautions.
- Cleaning, disinfecting and reprocessing of reusable equipment.
- Waste management ,Prevention of HAI in patients

The role of the hospital infection control committee (HICC) is to implement the annual infection control Programme and policies.

1. Commitment towards Maintenance of Surveillance over HCAIs.
2. Develop a system for identifying, reporting, analyzing, investigating and controlling HCAIs.
3. Develop and implement preventive and corrective programs in specific situations where infection hazards exist.

4. Advice the Medical Superintendent on matters related to the proper use of antibiotics, develop antibiotic policies and recommend remedial measures when antibiotic resistant strains are detected.
5. Review and update hospital infection control policies and procedures from time to time.
6. Help to provide employee health education regarding matters related to HCAIs.
7. HICC shall meet regularly - once a month and as often as required

Structure of Hospital infection control committee

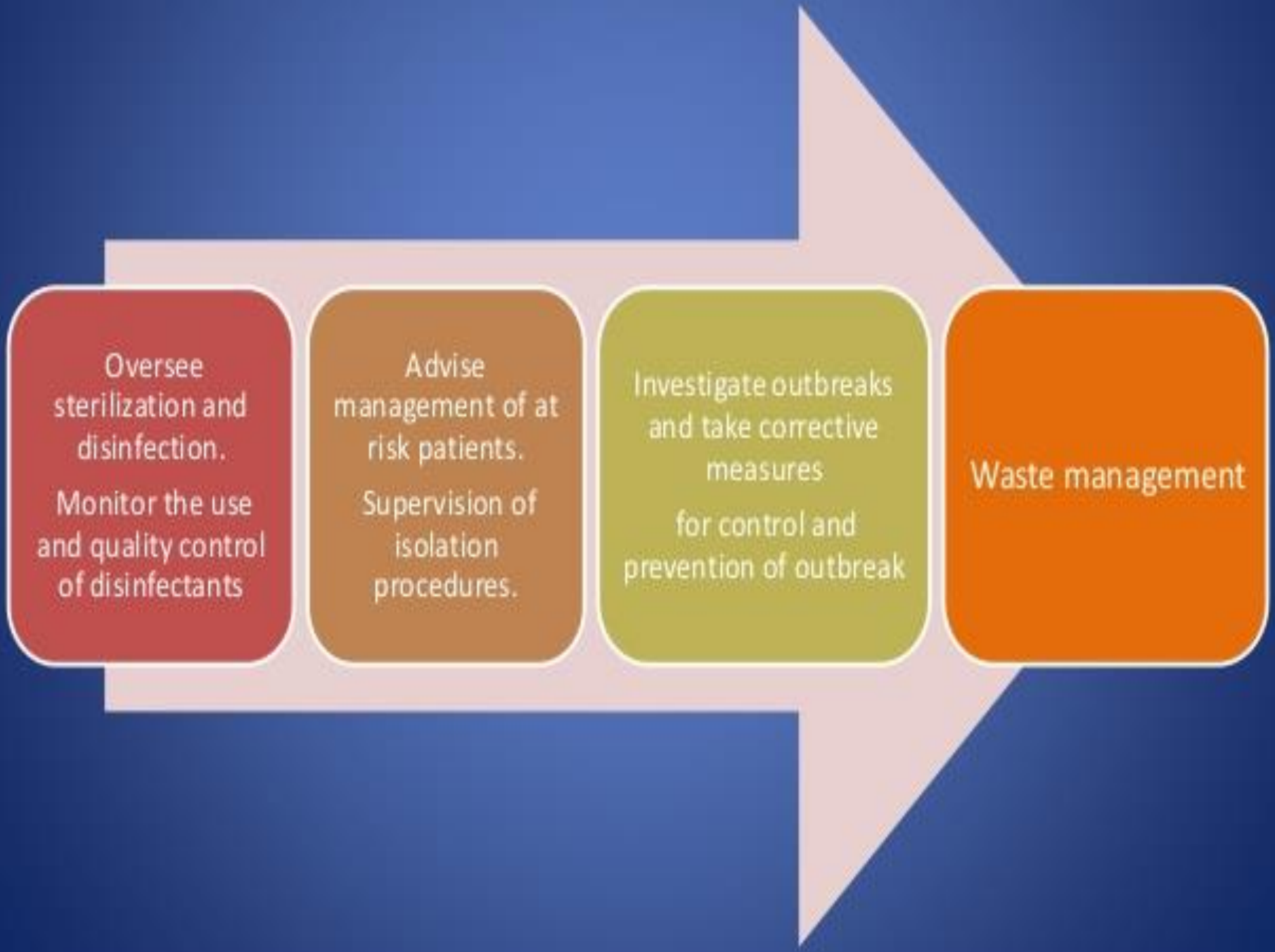
Infection Control Team

- The Infection control team should comprise of at minimum

1. an infection control officer,
2. a microbiologist (if ICO is not a microbiologist),
3. and infection control nurse.

ICT takes daily measures for the prevention and control of infection in hospital.

Responsibilities of Hospital Infection Control Team


Oversee sterilization and disinfection.
Monitor the use and quality control of disinfectants
Advise management of at risk patients.
Supervision of isolation procedures.
Investigate outbreaks and take corrective measures
for control and prevention of outbreak
Waste management


Training of all new employees as to the importance of infection control and the relevant policies and procedures.
Regular training programme for the staff to ensure implementation of infection control practices
Audit infection control procedures and antimicrobial usage
Monitor Health care workers safety Programme.