UNIT

### **Infection Control**



### **O** LEARNING OBJECTIVES:

### The students will be able to:

- 🧳 list the types of immunity.
- list the most common microorganisms associated with disease in each type of immune deficiency.
- list the main laboratory methods for most of the infections in immune compromised patients.
- 🤌 describe the infectious disease process (chain of infection).
- 🤌 understand the problem of nosocomial infection and how to prevent them.
- 🥖 describe hand hygiene procedures
- understand basic concepts of cleaning, disinfection and sterilization.
- understand the link between infection control, healthcare and Bio-medical waste management.

### 6.1 Introduction

Infection control refers to policies and procedures used to minimize the risk of spreading infection especially in hospital and human. Infection control is the discipline concerned with preventing nosocomial or healthcare associated infection, It is the practical sub discipline of epidemiology. Eventhough it is an essential, often under recognized and under supported part of the infrastructure of health care.

Infection control addresses factors related to the spread of infection within

the healthcare setting (whether patient to patient and from patient to staff and from staff to patients). Practices that control and prevent transmission of infection help to protect patients and health workers from disease. Infection prevention and control is required to prevent the transmission of communicable disease in all health care settings. Risk factors that increase patient susceptibility to infection. Health care workers should be vaccinated against preventable disease such as hepatitis B. Personnel at risk for exposure to Tuberculosis and HIV-AIDS should be screened per recommendations

used to reduce the risk of transmission of infectious agents from body fluids or environmental surface that contain infectious agents. ۲

Health care workers can protect themselves from contact with infectious material or exposure to communicable disease by having knowledge of the infectious process and appropriate barrier protection. Knowledge of Microbiology is an essential component in nursing for practicing disinfection and sterilization to eliminate pathogenic microbes causing infectious disease.

### 6.2 Immunity

The ability of a host to resist a particular infection or toxins by the action of specific antibodies or sensitized white blood cells produced by them in response to natural exposure of the organism is called as immunity

### 6.2.1 Immune System

A complex network of specialized cells, tissues, and organs that recognize and defend body against foreign substances. Primarily disease causing microorganism such as bacteria viruses, parasites and fungi.

### Lymphoid Organs:

- i. PRIMARY LYMPHOID ORGANS Thymus, Bone Marrow
- ii. SECONDARY LYMPHOID ORGANS Lymph Node, Spleen

These organs produce immune cells or T-cells, B-cells, NK cells, macrophages, leukocytes that help to fight against pathogens.



### 6.2.2 Factors Influencing the Immune Status of Individual Inherent

#### Species immunity

Species immunity is that in which a disease affecting one species does not affect the other species (Ex) Human do not infected by cattle plague, chicken cholera, while animals are not affected by enteric fever.

**Racial immunity:-** The immunity in which various races show marked differences, in their resistance to certain infectious disease.

(Ex) Black Africans affected by a sickle cell anemia (a genetic disease) are resistant to Malaria while Malaria affects other human races.

**Individual immunity:**-The same racial background and opportunity for exposure some individual of the race experience severe infection. (Ex) Children are more susceptible to disease such as measles, chicken pox while aged individuals are susceptible to pneumonia. Specific antibodies or sensitized white blood cells produced by them in response to natural exposure of the organism is called as immunity.

# 6.2.3 Types of immunity:- 3 types of immunity is in human.

- **1.** Innate immunity (natural or non specific)
- 2. Acquired (specific or adaptive) immunity
- **3.** Active and passive immunity.



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Do you eat fruits during cold and cough?

It has been proven scientifically that increased intake of fruits rich in vitamin c are in fact protective against cold and cough in children.

### Innate (natural or Non-specific immunity: -

It refers to the inborn ability of the body to resist and is genetically transmitted from one generation to the next. The immunity offers resistance to any microorganism or foreign material encountered by the host.

Natural immunity results after acquiring certain disease Ex. Measles. This immunity lasts a life time.

Innate immunity can be divided in to species, racial, individual immunity.

# Acquired immunity (Specific or Adaptive):

Acquired immunity refers to an immunity that is developed by the host

in its body after exposure to a suitable antigen or after transfer of antibodies.

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Immunity can be described as either active or passive, depending on how it is acquired.

Active immunity: - Active immunity involves the production of antibodies by the body itself and the subsequent development of memory cells.

**Passive immunity:** - Results from the acquisition of antibodies from another source and hence memory cells are not developed.

Active immunity will result in longterm immunity but passive immunity will not due to the presence or absence of memory cells.

Both active and passive immunity can be induced by either natural or artificial mechanism.

### Examples of active immunity: -

**Natural** – Producing antibodies in response to exposure to a pathogen if infection acquires. (e.g. Chicken Pox, Measles).

**Artificial** – Producing antibodies in response to the controlled exposure to an attenuated pathogen (e.g. vaccination)

### Examples of passive immunity: -

**Natural:** Receiving antibodies from another host. (e.g. IgG - mother to foetus via the placenta; IgA - From mother to new born via breast milk (colostrum)).

**Artificial:** - Receiving manufactured antibodies via external delivery (Blood transfusion of monoclonal antibodies).

6. Infection Control

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### Types of Immunity: -

### Example:



### Types of immunization:-

Active immunization: is the induction of immunity after exposure of an antigen. Antibodies are created by the recipient and may be stored permanently. Artificial active immunization is where the microbe is injected into the person before they are able to take it in naturally.

**Passive immunization:** - It can be provided when people cannot synthesize antibodies, and when they have been exposed to a particular organ that they do not develop immunity.

### **Student Activity**

Quiz on immune system (group activitywhat are the immune cells involved in immune function during infection)

Chart preparation – types of immunity

### 6.2.4 Vaccine: -Definition:

A Vaccine is a biological preparation that provides active acquired immunity to a particular disease. A vaccine typically

6. Infection Control

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contains an agent that resembles a disease causing microorganism and is often made from weakened or killed forms of the microbe, its toxin or one of its surface protein.

The agent stimulates the body's immune and that it may encounter in the future.

The term vaccine and vaccination were derived from variola vaccinia (smallpox of the cow) This term was first discovered by Edward Jenner in 1796.

### Types of vaccines:

- Live Attenuated Vaccine
- Inactivated Vaccine
- Subunit Vaccine
- Toxoid Vaccine
- Conjugate Vaccine
- DNA Vaccine

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**Recombinant Vector Vaccine** 

sun is important for the immune system. When a KNUMS person spends time in the sun their body produces vitamin D.

### Live attenuated vaccine:

Live microorganism modified to be less deadly or closely related microorganism that induce immune response. The organism can be attenuated by growing it in prolonged culture. Attenuation means the loss of virulence of the pathogen.

e.g. OPV, MMR (mumps, measles, Rubella) BCG, varicella vaccine, yellow fever.

6. Infection Control

### Inactivated vaccine or killed vaccine:

Whole microorganism destroyed by heat, chemicals, radiation, antibiotics.

e.g. Hepatitis A vaccine, Hepatitis B, Pneumococcal polysaccharide, IPV. influenza, Hib, Typhoid.

### **Toxoid vaccine:**

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Inactivated toxic compounds is toxoid. [toxins can be inactivated by using formalin]

Toxin + formalin toxoid

e.g. DPT, Antivenom, TT (tetanus toxoid)



Vaccine prevent more than 2.5 million death every year.

CDC (Center for Disease Control, USA) has reported a 99% reduction in the incidence of bacterial meningitis caused by Haemophilus influenza.

### Subunit vaccine:

A Protein component of the microorganism.

e.g. Surface Protein or Synthetic virus like particles lacking viral genetic material [unable to replicate] e.g. Hepatitis -B

#### Monovalent Vaccine:

Immunize against single strain of microorganism.

### **Multivalent Vaccine:**

Immunize against multiple antigens strains or micro organism

The children with malnutrition have low resistance to fight against

Nursing-Gen\_Chapter 06\_079-118.indd 83

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infection. Therefore children need timely immunization. All children have a rights to get vaccines, protection against preventable disease. Extremely malnourished children may show severe reaction to certain vaccines because they have low antibodies. e.g. Measles Vaccine.

Advantages of live/killed Vaccine:

### Live Vaccine:

ADVANTAGES	DISADVANTAGES
Single dose	Remote chance of reactivation of virus
Induce CMI	Cannot be used in immune compromised
Long lasting immunity	Need proper cold chain
Economical	
Suitable for mass immunization	

### **Killed Vaccine:**

ADVANTAGES	DISADVANTAGES
Safe	Multiple dose
Stable	Booster dose needed
Can be given as combined vaccines	Does not induce local immunity



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In the past 60 years vaccine helped to eradicate disease (small pox).

### Maintaining a cold chain:

It is essential to maintain the favorable temperature with cold storage, to maintain the potency of vaccines. The temperature should be around 2°C to 8°C. The vaccine should be kept under freezing compartment. The thermometer should be placed in cold place to confirm the validity.

During transportation, the vaccines should be placed in a container maintaining the cited temperature or in a plastic bag in the ice box.

The Vaccines should be arranged according to their expiry dates for the better use.

# Contraindications for the immunization:

- An acute illness with fever.
- When the child is on immune suppressive drug or on radiation.
- A child suffering from leukemia, lymphoma, malignancy.



Vaccine helped to reduce measles death globally by 78% between 2000-2008

6. Infection Control

	NATIONAL IM	IMUNIZATION S	SCHEDULE	
National Immunization Schedule for Infants, Children and Pregnant Women				
Vaccine	When to give	Dose	Route	Site
	Fo	r Pregnant Women		
TT - 1	Early in pregnancy	0.5ml	Intra-muscular	Upper Arm
TT - 2	4 weeks after TT - 1*	0.5ml	Intra-muscular	Upper Arm
TT - Booster	If received 2 TT doses in a pregnancy within last 3 years*	0.5ml	Intra-muscular	Upper Arm
		For Infants		
BCG	At birth or as early as possible till one year of	0.1ml (0.05ml till 1 month age)	Intra-dermal	Left Upper Arm
Hepatitis B	At birth or as early as possible within 24 hours	0.5ml	Intra-muscular	Antero-lateral side of mid thigh
OPV - O	At birth or as early as possible within the first 15	2 drops	Oral	Oral
OPV 1, 2 & 3	At 6 weeks, 10 weeks & 14 weeks\	2 drops	Oral	Oral
DPT 1, 2 & 3	At 6 weeks, 10 weeks & 14 weeks\	0.5ml	Intra-muscular	Antero-lateral side of mid thigh
Hep B 1, 2 & 3	At 6 weeks, 10 weeks & 14 weeks\	0.5ml	Intra-muscular	Antero-lateral side of mid thigh
Measles	9 completed months - 12 months	0.5ml	Sub-cutaneous	Right upper arm
Vitamin-A (1st dose)	At 9 months with measles	1 ml (1 lakh IU)	oral	Oral
		For Children		
DPT Booster	16-24 months	0.5ml	Intra-muscular	Antero-lateral side of mid thigh
Measles 2nd dose	16-24 months	0.5ml	Sub-cutaneous	Right upper arm
OPV Booster	16-24 months	2 drops	Oral	Oral
Japanese Encephalitis**	16-24 months	0.5ml	Sub-cutaneous	Left Upper Arm
Vitamin-A***				
(2nd to 9th dose)	16 months. Then one dose every 6 months upto the	2ml (2 lakh IU)	Oral	Oral
DPT Booster	5-6 years	0.5ml	Intra-muscular	Upper Arm
Π	10 years & 16 years	0.5ml	Intra-muscular	Upper Arm

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\* Give TT-2 or Booster doses before 36 weeks of pregnancy. However, give these even if more than 36 weeks have passed. Give TT to a woman in labour, if she has not previously received TT.

\*\* JE Vaccine, in select endemic districts after the campaign.

\*\*\* The 2nd to 9th doses of Vitamin A can be administered to children 1 - 5 years old during biannual rounds, in collaboration with ICDS.

6. Infection Control

85

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### 6.2.5 Infection & Its transmission:

**1.** Entry of infection into human body:

Microorganism may enter the body in one of the below three ways.

- Digestive tract Swallowed in contaminated food or water.
- Respiratory tract air contain pathogens
- Skin and mucous membrane through a wound, weekend surface or injections
- 2. Organism leave the body of an infected person:
- Excreta Feces and urine.
- Coughing and sneezing and sputum
- Pus and wound discharges
- Blood (Mosquito bite and injection needles)

### **3.** Routes of transmission:

- Fecal to oral route.
- Feces to Skin.

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Droplet infection

#### 4. Prevention of infection:

- Hand washing before preparing or eating food.
- Eating only clean food, kept free from flies.
- Handwashing after defecation.



Spirilla e.g. Campylobacter jejuni

6. Infection Control

- Drinking boiled water.
- Avoid crowded places.
- Immunization specially to protect children.
- Cover the mouth and nose when coughing.

### 6.3 Micro organism

### 6.3.1 Definition

Microorganism or microbe is a living thing that is too small which is invisible to the naked eye but it can be visible under microscope. The study of microbes is called as microbiology.

Microorganisms are divided into seven types.

Bacteria	Fungi
Archea	Viruses
Protozoa	<ul> <li>Multi cellular animal parasites (helminthes)</li> </ul>
Algae	

Each type has a characteristic cellular composition morphology, motility or locomotion, reproduction.

Bacteria are prokaryotic organism. (single celled microbes). The cell structure is simple than that of other organism. Bacteria are classified into many groups according to the Morphology of Bacteria:



Spirochetes e.g. Treponema pallidum

86

19-02-2019 16:29:45



Diplococci arranged in pairs

e.g. Streptococci pneumoniae



**Pleomorphic** e.g. Corynebacterium diptheriae



**Rod shaped bacteria** e.g. E. coli

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**Peritrichous flagella** e.g. Salmonella typhi



**Endospore** e.g. Clostridium tetani



**Cocci in chains** e.g. Streptococcus pyogenes

# Cocci in chains (Spherical form or oval) Streptococci Cocci in cluster Image: Cocci in cluster Image: Cocci in cluster Image: Cocci in cluster Staphylococci 87

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Type of Bacteria based on morphology:-

Cocci in pair		Diplococci e.g. Diplococci pneumoniae
Chain of bacilli		Bacilli in chains
(Rod shaped)		e.g. Lactobacillus sp
Spirochete	(P	Corks Screw
(Flexible spiral form)	Source ~	e.g. Treponema pallidum
Vibrio		Comma
(Comma shaped)		e.g. Vibrio cholerae

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The opposite of antibiotics is probiotics. It favours the growth of beneficial microorganism in the body. e.g. Curd

It kills the harmful bacteria (pathogens).

e.g. Probiotics-**Bifidobacterium**, Lactobacillus.

### Bacteria can be divided into two,

- **1.** Beneficial bacteria
- 2. Harmful bacteria (pathogenic bacteria)

6. Infection Control

Beneficial bacteria in the body is plays an important role in human survival. Bacteria in the digestive system break down the food substance and produce Vitamin K (**E.coli.**) Beneficial bacteria are also called probiotics. The normal flora are bacteria which are found in or on bodies. The presence may be temporary or permanent basis without causing any disease.

### 6.3.2 Harmful bacterial infection

Harmful bacteria are called pathogenic bacteria because they cause disease and illness in human and animals.

88

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Classification of bacteria into gram positive and gram negative based on the cell wall composition.

Gram positive cocci in chains	_	Streptococcus pyogenes
Gram positive cocci in Clusters	-	Staphylococcus aureus
Gram negative Cocci in pairs	_	Neisseria meningitis
Gram positive Bacilli in chains other bacteria	_	Bacillus anthracis
Acid fast bacilli	_	Mycobacterium tuberculosis
Endospore forming	_	Clostridium tetani
Pleomorphic	_	Corynebacterium diphtheria
Gram Negative Bacilli	_	Escherichia coli

When bacteria is present in our body in the absence of disease is called as colonizer. However people can get infection from Pathogenic bacteria through contaminated water, food and air

### Skin infection:-

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The organism most commonly found in the skin and mucous membrane. It cause superficial and systemic infections. e.g. Staphylococcus aureus

**Superficial:** Boils, impetigo, foliculitis, Pneumonia, Food poisoning, bacteremia.

**Respiratory tract infection:** - The organism which is more found in the mouth as a normal flora. The infection may be in the upper tract or lower respiratory tract.

### Ex. Streptococcus pyogenes

6. Infection Control

Upper		-	Sore throa	at
Respiratory tract		Laryngitis		
			Pharyngit	is
Lower Respirator	y tract	_	Pneumon Tuberculo	ia and osis
NON KNOM5	ENZYM Immun Assay	4E NO -	LIN Sori Elisa.	IKED BENT This

technique is used to detect antibodies of HIV Infection.

### Gastro intestinal infection: -

Many different species of gram negative bacilli normally found in the intestinal tract. It cause inflammation of the gastrointestinal tract involving both stomach and the small intestine. Symptoms include diarrhoea, vomiting, and abdominal pain.



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 All the bacteria in our body collectively weigh more than 4 pounds [2kg-bacteria]

### Genitourinary tract infection: -

A urinary tract infection (UTI) is an infection in any part of urinary system kidney, uterus, bladder, urethra. However, serious consequences can occur if a UTI spreads to your kidney.

Lower urinary tract	-	Cystitis
Upper urinary tract	-	Pyelonephritis

The most commonly UTI causing organism is **Escherichia coli** 

89

### **Bacterial Infection**

BACTERIA	LOCATION	INFECTION
<ul><li>Streptococcus pneumoniae</li><li>Neisseria meningitidis</li><li>Haemophilus influenza</li></ul>	Brain (meninges)	meningitis
• Streptococcus Pneumoniae	Ear	Otitis media
<ul> <li>Streptococcus Pneumoniae</li> <li>Staphylococcus aureus</li> <li>Mycoplasma pneumonia</li> <li>Mycobacterium tuberculosis</li> </ul>	Lungs( inhalation)	<ul> <li>Lower Respiratory infection <ul> <li>Pneumonia</li> <li>Tuberculosis</li> </ul> </li> <li>Upper respiratory tract <ul> <li>Sore throat</li> <li>Sinusitis</li> <li>Pharyngitis</li> </ul> </li> </ul>
<ul><li>Staphylococcus aureus</li><li>Streptococcus pyogenes</li><li>Pseudomonas aeruginosa</li></ul>	wound	Skin infection – Cellulitis – Abscess – Impetigo
<ul><li>Escherichia coli</li><li>Pseudomonas aeruginosa</li></ul>	Urinary tract	Urinary tract infection – Urithritis
<ul> <li>Salmonella</li> <li>E.coli</li> <li>Shigella</li> <li>Clostridium</li> <li>Staphylococcus aureus</li> </ul>	Ingestion (oral)	Typhoid Travellers diarrhoea Bacillary dysentery Tetanus Food poisoning
• Helicobacter pylori	Stomach	Gastritis(Ulcer)
<ul><li>Staphylococcus aureus</li><li>Neisseria gonorrhoeae</li><li>Chlamydia trachomatis</li></ul>	Eyes	Eyes infection Conjunctivitis Trachoma
<ul><li>Neisseria gonorrhoea</li><li>Treponema pallidum</li><li>Haemophilus ducreyi</li></ul>	Sexual contact	Sexually transmitted disease Gonorrrhoea Syphilis

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### Student Activity

Visit - observation of biomedical waste management in nearby hospital

### 6.3.3 Viruses

Viruses are obligatory intracellular parasites. They multiply by using the host cells. Synthesizing machinery to cause

6. Infection Control

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the synthesis of specialized elements that can transfer the viral nucleic acid to other cells. They are ultra-microscopic structure and are not visible in ordinary microscope. They are visible only under electron microscope.



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Microbes generate at least 50% of the oxygen we breathe.

### **Viral Infection**

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VIRUSES	LOCATION	INFECTION
<ul> <li>Measles</li> <li>Rabies</li> <li>J C Virus</li> <li>Arbo virus</li> </ul>	(Meninges) Brain	Encephalitis Meningitis
• Rhino virus • Influenza virus	Respiration( inhalation)	Common cold
<ul><li>Herpes simplex virus</li><li>Adeno virus</li><li>Cytomegalo virus</li></ul>	Eyes	Eye infection Conjunctivitis
• Herpes simplex type 1	Gums	Gingivostomatitis, Cold sore
<ul> <li>Adeno virus</li> <li>Epstein Barr virus</li> <li>Cytomegalo virus</li> <li>Respiratory syncytial virus</li> <li>Parainfluenza viurs</li> <li>SARS Coronavirus</li> </ul>	Lungs (Inhalation)	Pharyngitis Infectious mononucleosis pneumonia
<ul><li> Polio virus</li><li> Mumps virus</li></ul>	Myelin Oral	Poliomyelitis Parotitis
Cox sackie B virus	Heart	Cardio Vascular infection
<ul> <li>Rota virus</li> <li>Noro virus</li> <li>Coxsackie B virus</li> </ul>	Ingestion(oral)	Gastro enteritis Pancreatitis
<ul><li>Heptatitis virus</li><li>Type A,B,C,D,E</li></ul>	Blood transfusion, Infected mother's millk	Hepatitis(Jaundice) Liver cirrrhosis
<ul> <li>Rubella</li> <li>Measles</li> <li>Human papilloma virus</li> <li>Varicella zoster virus</li> </ul>	Direct contact(air) Skin	Skin infection(koplik spot) Genital warts and cancer Chicken pox

6. Infection Control

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Dengue Virus



Chikungunya Virus

# 6.3.4 Methods used for identification of microbes:-

Bacteria are single celled microorganism and are invisible to naked eye. Bacterial identification is a necessary part of disease diagnosis and treatment without the identification of causative bacteria is very tough to provide effective treatment with available antibiotics.



6. Infection Control

object by multiplying the magnification of the objective lens and magnification of the ocular lens. •

- The compound light microscope uses visible light.
- The maximum resolving power (ability to distinguish two points) of a compound light microscope is 0.2 μm
- Oil immersion lens is used to reduce the light loss and increases the resolving power.

### **Types of Microscope:-**

- Bright field microscope
- Dark field microscope
- Phase contrast microscope
- Flourescence microscope
- Electron microscope

### **Compound Light Microscope**



### **Electron Microscope:**

Electron microscope use beam of electrons and it has the magnification

power of 10,000 to 1,00,000 x. It is used to view ultra-structure of viruses and other organisms



# Preparation of specimens for light microscopy: -

### Preparing smears and staining:

- A smear is a thin film of material used for microscopic examination. Place a drop of saline or distilled water and mix the specimen with a sterile inoculation loop.
- Spread the specimen uniformly on the slide.
- Fixing uses air and heat to attach microorganisms on a slide.

### Staining: -

- Gram staining method
- Acid-fast staining method



6. Infection Control

19-02-2019 16:29:49

### Fixing:

After smear preparation the glass slide should show for 2 to 3 times in a flame. Due to flaming the specimen get fixed perfectly on a slide and also some chemicals like formalin, Methyl alcohol, Mercuric chloride is used for fixing the specimen.

**Stains**: - Stains is used to make cellular shapes and arrangements visible. For e.g. The stains used in gram staining – **Crystal violet, saffranin**)

(decolorizer -Ethyl alcohol, Mordant agent – grams Iodine).



Ear wax having anti-microbial properties that reduce the feasibility of bacteria and fungus in the human ear.

# Hanging Drop Method: - (Glass slit method).

In hanging drop method, a drop of culture is made to hang between glass slide and slit and viewed under microscope.

The advantage of hanging drop method is we can identify mobile bacteria. Some bacteria have flagella for motility. e.g. Monotrichous, Peritrichous flagella (e.g. Proteus)

### By cultural characteristics: -

Here bacteria are identified as group or culture as a whole and note individual bacteria some most bacteria grow in colonies and also divide fast. They can be easily grown into a culture in suitable nutrition media. Based on the characteristics of culture they can be identified as the size of colonies, type of elevation, margins, surface of colony, colour of culture.





### **Based on Antibiotic Resistance**

Antibiotics (Ex-Penicillin) is added to the culture and measuring the resistance of microbe. The zone of inhibition surrounding the antiobiotic disc indicating sensitivity

No zone of inhibition surrounding the antibiotic disc indicating resistance.



#### By Biochemical test: -

Sugar fermentation test

- Litmus milk test
- Indole production test

6. Infection Control

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- Methyl Red test
- Citrate utilization test

### By differential staining: -

The identification depends on staining of bacteria. And most bacteria can be stained by specific stain like crystal violet. Gram positive bacteria are stained by gram stain while Gram negative bacteria don't take up gram stain.

Mycobacterium tuberculosis bacteria can be stained by acid fast staining method.

**Serological methods:** - Here identification of bacteria is done by use of antibodies and antigens which are specific against the suspected bacteria. Antigens and antibodies are very specific and bind to single type of bacteria.





Identification of bacteria is necessary to

- **I.** Identify the disease
- **II.** Select suitable drug
- **III.** Evaluation of treatment progress

- **IV.** For industrial purpose.
- V. Storage

### 6.3.5 Types of specimen collection

**Swabs:** - It is usually collected in a sterile cotton swab, care should be taken so as to prevent contaminations of specimen. (e.g. Throat swab, Eye, Ear, Nose, Mouth, Vaginal, Abscesses swab). Materials should be taken only from the infected area.

**Sputum:** - It should be collected in a sterile container having wide mouth. Sputum should be collected directly after a cough and sent immediately to the laboratory.

**Urine**: - Urine specimen remains an important tool for clinical diagnosis. A correct urine result is influenced by the collection method, timing and handling (first morning sample, random sample). It should be collected in a sterile container.

**Faeces**: - Fresh stool should be collected for bacteriological examination. Specimen should be well covered and labelled.

For culture and parasite examination the specimen must be returned to the laboratory within one hour of collection.

**Blood:** - It is important that specimens are properly collected, prepared and preserved. When assisting the physician should adopt aseptic precautions so as to avoid contamination of specimen.

Always collect the blood specimen in hygienic area. Blood is carefully transfer from the syringe to the tube

6. Infection Control

and gently invert 2-3 times to thoroughly mix the anticoagulant with the blood (heparin) ۲

### 6.4 Terminologies

**Pathogens**: - The microorganisms able to cause disease. (disease-causing organisms is called as pathogens.)

**Disease:** - Any change from a state of health. The pathogens multiply and cause an alteration in normal tissues and manifest with signs and symptoms.

**Normal Flora**: - Collection of organisms that colonize an animal, human surfaces or in the body without causing disease.

**Infection**: - Growth of microorganism in the body.

Asymptomatic infection: - If the microorganism fails to cause severe injuries to cells or tissues and patient is symptom free from particularly disease.

### Communicable disease: -

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If the infectious disease can be transmitted directly from one person to another. It is known as communicable disease or contagious disease.

Acute infection: - Any disease in which symptoms develop rapidly but last for only a short time.

**Chronic disease**: - An illness that develops slowly and is likely to continue as recur for long periods.

**Disinfection**: - It is a process by which pathogenic organisms are killed by physical and chemical agents.

**Disinfectant**: - It is a chemical substance, which kill the pathogenic organism Ex. Iodine, Phenol, Carbolic Acid.

**Antiseptic**: - It is a chemical substance which inhibit the growth of organism and do not kill the organism Ex-Lysol.

**Detergent**: - Any substance that reduce the surface tension of water.

**Bacteriostatic**:-It is a process of inhibiting the growth of bacteria. Ex. Freezing and drying.

**Bactericide**: It is a substance which kills bacteria.

**Sepsis**: - It is a term used for the presence of pathogenic organism.

**Inflammation:** A host response to tissue damage characterized by reddening, pain, heat, swelling.

Antigen: - Any substance (microorganism) that when introduced into the body which induce antibody formation and reacts only with its specific antibody.

**Antibodies**: - Antibodies are large glycoprotein molecule produced by the body in response to an antigen and capable of combining specifically with the antigen.

Antibodies are also called as immunoglobulin which are synthesized and secreted by plasma cells when an antigen enters the body to neutralize the antigen.

Types of Immunoglobulin Ig G, Ig A, Ig M, Ig D, Ig E

- IgA = Mostly in secretion (tears, saliva, milk)
- IgG = Crosses the placenta (mother to baby)

6. Infection Control

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19-02-2019 16:29:50

**Sterilization:** - is a process by which an article or surface or medium is free from Microorganism (vegetative, spore state)

**Chemotherapy**: - Treatment of a disease with chemical substance (sulfonamides).

**Antibiotics:** - An antimicrobial agent produced naturally by a bacterium (or) fungus.

e.g. - Ciprofloxacin Streptomycin by Streptomyces griseous.

**Serum:** A liquid remaining after blood plasma is clotted which contains immunoglobulin.

**Local infection**: - An infection that is localized within a particular part or a single organ. Proper care can control spread.

### Systemic infection: -

An infection that affects the entire body. It can become fatal.

### 6.5 Infection Process

Infection is the invasion or colonization of the body by pathogenic microorganisms.

Disease occur when an infection results in any change from a state of health.

Development of an infection occurs in a cycle that depends on the following elements.

- An infectious agent or pathogen Ex. Salmonella
- A continual source of infection is called a reservoir of infection (spread of infection)
- A mode of transmission of disease
- A portal of entry to a host
- A susceptible host.

An infection will develop if this chain remains intact. Nurse use infection prevention and control practices to break the chain so that infection will not develop.







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When you cough germs can travel about 3 metres. If you do not put your hand or hand kerchief.

### 6.5.1 Chains of infection:

### i) Infectious Agent: -

Microorganisms include bacteria, viruses, fungi and protozoa. They are common infectious agents or pathogens. The potential for microorganisms to cause disease is depends on the following factors.

- Sufficient number of pathogens (Inoculum) which enter into the body.
- Virulence or ability to produce disease.

- Ability to enter and survive in the host (overcome the immune system of the host).
- Susceptibility of host.
- **ii) Reservoir**: A reservoir is where a pathogen can survive.
  - A continual source of infection is called a reservoir infection.
  - People who have a disease are carriers of pathogenic organisms (human reservoir).
  - Zoonoses can be transmitted to humans from animal reservoirs of infection.
  - Some pathogenic microorganisms grow in nonliving reservoirs Ex-Soil, Water.

6. Infection Control

- iii) Portal of exit: -
  - Pathogens have preferred portals of entry, they also have definite portal of exit.
  - **3** common portal of exit.

**Respiratory tract** – coughing, sneezing

**Gastro intestinal tract** – Saliva, feaces

**Genital tract** – Vagina and penis

- Arthropods and syringes provide a portal of exit for microbes in blood.
- iv) Modes of transmission: -

Mode of transmission is through direct or indirect contact, droplet

infection, vehicle transmission, air borne, arthropod vector.

### v) Portal of entry: -

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Organism can enter the body through skin, mucous membrane, gastro intestinal tract, intestinal tract, blood, genital tract.

### vi. Compromised host: -

When a person acquires an infection depends on the susceptibility of an infectious agent.

- Individual degree of resistance to a pathogen.
- Patients with burn, surgical wounds, and suppressed immune system are the most susceptible.
- According to the virulence of the microbes.

ROUTES AND MEANS	TRANSMISSION	EXAMPLE (ORGANISM)
DIRECT CONTACT	PHYSICAL CONTACT	CHICKEN POX, MEASLES, RUBELLA
INDIRECT CONTACT	FOMITES (IN ANIMATE OBJECTS)	INFLUEZA (COMMON COLD)
DROPLET INFECTION	SALIVA, MUCUS	MYCOBACTERIUM TUBERCULOSIS
VEHICLE BORNE INFECTION	WATER, FOOD, AIR, Blood	V.CHOLERAE, SALMONELLA Shigella
AIR BORNE INFECTION	WATER DROPLETS	INFLUENZA
VECTOR :-		
MECHANICAL	FLIES	SALMONELLA
&	MOSQUITO	ADES EGYPTIA
BIOLOGICAL	LOUSE	RICKETTSIA TYPI

6. Infection Control

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Tears contain Bactericides such as lysozyme. So it kills bacteria (sometimes crying is good)

### 6.5.2 Course of Infection

Once a microorganism does overcome the defenses of the host, development of the disease follows a certain sequence of steps that tends to be similar whether the disease be acute or chronic.

- Incubation period
- Proximal stage
- Period of illness stage
- Period of decline
- Period of convalescence

**Incubation Period**: - The period of incubation is the time interval between the actual infection and the first appearance of signs and symptoms interval between entrance of pathogen into body and appearance of first symptoms.

### e.g. Common cold - 1 to 2 days Mumps - 18 days

**Prodromal Stage:** -The prodromal period is characterized by the appearance of the first mild signs and symptoms (lowgrade, fever, fatigue). During this time microorganism grow and multiply and patient is more capable of spreading disease to others.

**Illness Stage:** - During this period of illness, the disease is at its height and all disease signs and symptoms are apparent.

e.g. Common cold - Sore throat, sinus

### Mumps - Earache, high fever, parotid, salivary gland swelling

The severity of the patients' illness depends on the extent of infection, the pathogenicity of the microorganism, susceptibility of individuals.

### **Decline Stage: -**

During the period of decline, the signs and symptoms subside.

### **Convalescence Period: -**

During the period of convalescence, the body returns to its predeceased state, the health is restored. Length of recovery depends on severity of infection and patients' general health status. Recovery may take several days to month.





6. Infection Control

### 6.5.3 Defense Against Infection: -

- **1.** The immune system is one portion of the body's defense against infection.
- 2. Normal body flora that reside inside and outside of the body protect from several pathogens.
- **3.** Skin and mucous membrane both prevent pathogens from entering the body by creating a barrier, mucous traps microorganisms.
- **4.** Skin & Mucous Membrane
  - Acidity of Skin,
  - Saliva, tears (Ig A)
     Nostril hairs
     Stomach Acidity

Provide first line of Defense against Infection it contains Ig A ۲

The inflammatory response is a protective vascular and cellular reaction that neutralizes pathogens and repair body cells.

Inflammatory response – bring blood and therefore more phagocytes to the area.

- IgA is predominantly present in secretion (tears, saliva, milk) is the first line of defense.
- Lysozyme is present in phagocytes which digest the foreign particles, break the cell wall of gram positive bacteria

### **Student Activity**

Hanging drop technique -to observe the movement of microbes under microscope in different water sample



### 6.5.4 Types of Infection: -

**Nosocomial Infection:**-It is defined as any infections that are acquired during the course of stay in a hospital, nursing home, or other health care facility health care workers.

**Iatrogenic** Infection:-Iatrogenic infections are a type of nosocomial infection resulting from a diagnostic or therapeutic procedure.

i.e. UTI that develops after catheter insertion

Exogenous

Endogenous

**Exogenous Infection**: - Exogenous infection arises from microorganism external to the individual which do not exist as normal flora

Ex. Salmonella typhi – Typhoid fever

**Endogenous Infection**: - Endogenous infection occurs when part of the patient's normal flora becomes altered (virulent) and also increase in number it will become opportunistic infection. Ex. Streptococci in mouth

E. coli in intestine as normal flora which may cause UTI. When it reach the urinary bladder.

6. Infection Control

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Nursing-Gen\_Chapter 06\_079-118.indd 101



Deinococcus radio durans can live in soil. It can tolerate/resist almost 10,000 times the dose of radiation lethal to human [in space microbiology]

# 6.5.5 Sites and causes for cross infection: -

I.	Urinary tract infection	-	Insertion of urinary catheter Improper hand washing technique Contaminated catheter tube and bag reflux of urine from bag to bladder.
II.	Surgical wound infection	-	Improper hand washing Improper sterilization of instruments and dressing material failure to use aseptic techniques
III.	Blood stream (Bacteremia)	-	Contaminated intravenous fluid, blood, needles
IV.	(RTI) Lower Cutaneous infection	-	Pneumonia (Respiratory devices) New born have high rate of
			infection.

### Risk factors for infection: -

- Broken skin or mucous membrane
- Obstructed urine outflow
- Decreased mobility

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Reduced hemoglobin level

### 6.6 Sterilization: - Definition

It is a process of making something free from bacteria or other living organism either in vegetative or spores. The removal of all microorganism from an object or surface.

### Disinfection: -

The process of cleaning something. Especially with a chemical in order to destroy or kill bacteria, but not necessarily spores.

- Physical method
- Chemical method
- Radiation
- Filtration
- Mechanical



Beef tape worm-It is the largest parasite in human intestine which can grow (7 <sup>1</sup>/<sub>2</sub> metres or 25feet long)

### **Student Activity**

Classroom assignment – sterilization method

6. Infection Control

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### 6.6.1 Methods of disinfection and Sterilization:



### 6.6.1.1 Mechanical Method

**Scrubbing:** Hand washing is one of the important procedures of a nurse in order to control and prevent self-infection as well as cross infection.

**Filtration**: Filtration is the passage of a liquid fluid or gases through a filter with

pores small enough retain microbes – vaccine, toxins, enzymes.

e.g. - HEPA filter, Membranes filters (nitrocellulose)

**Sedimentation**: - It is used in the purification of water by this method the suspending material together with

6. Infection Control

103

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Nursing-Gen\_Chapter 06\_079-118.indd 103

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bacteria settles down in the bottom of liquid.

### 6.6.1.2 Physical methods: -

**Sunlight**: Sunlight contains UV rays which cause thymine dimer in the DNA of bacterial cells. These UV says stops the replication of DNA in bacterial cells. These rays has more antimicrobial action e.g. Blanket, Pillows.

### Dry heat: -

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### Direct flaming: -

- Very effective method of sterilization.
- Burning contaminants to ashes.

This is used to sterilizing inoculation loops and sterilizing needles and instruments killing organisms.

**Incineration**: All hospital wastages like dressing, garbage, contaminated materials are completely bunt by incineration. It is very effective to kill all organism.

Hot air oven: This instrument is used to sterilize glassware, syringes, needles, culture tubes and enhance the growth of micro organism in culture media The vegetative forms of bacteria can be killed by this at 160°C for1 hour.



### Hot air oven

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### Moist heat Sterilization: -

**Boiling:** At a temperature of 100°C boiling for 3 to 5 minutes kill microorganisms except spore bearing organisms.

This method is suitable for enamel, metal, glass, rubber wares.

### Points to remember: -

- The article must be cleaned by scrubbing to remove the organic matter.
- Great care should be taken for glass articles and they should be wrapped

with cloth and put in cold water and then brought to boil.

- The organic matter which will coagulate around the organism and protect them.
- Testing material to check effectiveness of sterilization.

**Autoclaving** (Above 100°C temperature)

Spore bearing organism Ex. Clostridium tetani are killed by steam under pressure.



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Autoclave is an apparatus used for sterilization of articles by steam under pressure.

It is a metal chamber with an outer jacket and a lid, which can be firmly clamped. Steam is generated by heating water in a boiler or in the outer jacket.

In this the steam is allowed to circulate in a closed container and it is compressed and there by raises the temperature above the boiling point of water (at 121°C for 15 to 30 minute). Then the heat is turned off. The steam is evacuated.

### Uses: -

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The materials sterilized by autoclaving method are dressing, gloves, lines, syringes, certain instruments and culture Medias.

### Points to remember:

- i. All articles should be clean and dry before packing. Any organic matter such as blood or pus prevents penetration of steam.
- ii. The holes in drum must be open when placing into the auto clave, and closed immediately on taking them out.
- iii. Rubber gloves cannot stand high temperature and long sterilizing. Autoclave those separately at 15 lbs. pressure for 15 minutes.
- iv. To auto clave bottles of fluids loosen the screw caps, evacuate the steam slowly.

# Pasteurization: (Temperature at 62.8°C)

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In pasteurization a high temperature is used for a short time (72°C for 15 minutes) to destroy pathogens without altering the flavor of the food. This process is used to kill all the pathogenic organisms in milk, cream, and certain alcoholic beverages.

### 6.6.1.3 Chemical Methods

Certain chemicals are used in disinfection of articles like thermometer and also the disinfection of floor and de-contamination of infected linen.

### Chemical Substance which are commonly used:

- 1. Dettol: This is widely used chemical for Sterilization of instruments, thermometer etc. 5 to 50% of solution is used for drawings and wound irrigation.
- **2.** Savlon: 1:30 solution is used to destroy or kill vegetative bacteria.
- 3. Chloride of lime (bleaching powder): This is used for disinfection of drinking water, stools, urine, sputum. As it decomposes quickly when exposed to air. Solutions must be prepared fresh for each use.
- 4. Formalin: A 40% solution is used to disinfect faces, urine and sputum. It is not used for the skin and tissue, as it is an irritant.
- **5.** Tincture of Iodine: 1-2% iodine is used for cleaning skin and treating injuries to the skin.

6. Infection Control

- 6. Hydrogen peroxide: 1-5% of solution is used in cleaning wounds and to remove pus from infected ears. Hydrogen peroxide is also used to clean the mouth. It is an oxidizing agent.
- Potassium Permanganate: It is an oxidizing agent used for cleaning the mouth with 1:1000 strength. It is also used for irrigation of wounds.
- Carbolic acid (Phenol): It is a good designating for feces, pus, blood and sputum. It is a skin irritant and a poison. Dissolves early in hot water. For thermometer 1:20 solution for a duration of 10 minutes.
- **9.** Lysol: This is a phenol preparation mixed with soap. It is less poisonous than a carbolic acid but has a greater bactericidal action. 2% of solution for 6-8 hours is used for disinfecting linens.
- Ethyl Alcohol: 70% is effective for skin disinfection. Certain gases like formaldehyde and glutaraldehyde are used in disinfection of rooms.

### 6.6.1.4 Radiation:

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The effects of radiation depend on its wave length, intensity, duration.

### Ionizing radiation –

- Gamma rays and x-rays are both types of high energy electron (high frequency) electromagnetic radiation
- These rays can cause destruction of the DNA in microbes.

The principal effect of ionizing radiation is the ionization of water, which forms highly reactive hydroxyl radicals.

### Non-Ionizing radiation: UV rays

UV light damages the DNA of the exposed cells. It causes bonds to form between adjacent thymine dimers in DNA chain and inhibit replication.

### USES: -

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The radiations are used for sterilizing pharmaceutical and medical dental carries. (cold sterilization)

Practical application is the UV lamp (germicidal property) in the microbiological laboratories.

# 6.6.1.5 Fumigation (0r) Gas Sterilization

Fumigation is a process of gaseous sterilization which is used for killing of microorganisms and prevention of microbial growth in air, surface of wall or floor.

- It is generally used in the pharmaceutical, operation theatres. Hospitals, and offices.
- For effective fumigation process is done according to the density. Humidity 60% and temperature never below 18° C in opened area around at a time of 1 hour to o16 hours it may be differ the gas kill all the spores, vegetative cells etc.,

6. Infection Control

107

#### Gaseous agents

- Formaldehyde
- Ethylene oxide
- Glutaraldehyde
- Propiolactone

**Disadvantage:** These gas may cause irritant to the eyes, and mucous membranes and un wanted odors.

### 6.6.1.6 Low temperature:

Cold has the effect of decreasing or completely stopping the growth of bacteria constant freezing will destroy and inhibit the growth of bacteria.

In freeze condition the organisms growth may be delayed or inhibited. The organisms can be destroyed often is freeze conditions.

### Principles to be observed:

- 1. All articles contaminated with blood, feces, pus, sputum or other substances must be rinsed with cold water to prevent coagulation of protein material.
- 2. Use soap and water for cleaning the instruments and use a brush whenever necessary.
- **3.** Allow sufficient time for articles to be disinfected or sterilized by physical or chemical agents.
- **4.** It is importance to select the right disinfectant, the right strength and the right time.
- **5.** Use the right procedure to render instruments and other articles safe for further use in order to prevent the spread of infection.

### 6.7 Universal Precaution

### **Definition:**

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Universal precaution is an approach to infection control to treat all human blood and certain human body fluids as if they were known to be infectious for HIV, HBV and other blood borne pathogens.

#### Need for universal precautions: -

- Use barrier protection to prevent skin and mucous membrane contact with blood or other body fluids.
- Wear gloves to prevent contact with blood, infectious material or other, potentially contaminated surfaces or items.
- Wear face protection if blood or bodily fluid droplets may be generated during a procedure.
- Wear protective clothing if blood or bodily fluid may be splashed during a procedure.
- Wash hands and skin immediately and thoroughly if contaminated with blood as body fluid.
- Wash hands immediately after gloves are removed.
- Use care when using or handling sharp instruments and needles. Place used sharps in labeled, punctured resistance container.
- If you have sustained an exposure or puncture wound, immediately flush the exposed and notify your supervisor.

6. Infection Control

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#### Nursing-Gen\_Chapter 06\_079-118.indd 108

### HIGHLY INFECTIOUS BODY FLUIDS

Blood	Feces		
Semen	Nasal Secretion		
Vaginal	Sputum		
CSF	Sweat		
Synovial Fluid	Tears		
Amniotic Fluid	Urine / Vomitus Saliva		

The concept of universal health precaution emphasizes that all our patients should be treated as though they have potential blood borne infections and can infect the health care workers.

### **Hospital Infection:**

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MICROBIAL SOURCE + TRANSMISSION + SUSEPTIBLE HOST = INFECTION



Care should be taken when using sharp needles, ampoules (needle stick injuries can spread HIV, HBV, HCV)



Use of impervious gown

Avoid soaking our inner clothes and exposure to harmful microbes



Use of mask, cap, eyewear, foot wear

It will protect us from splashes of body fluids and out patients.





Use of a pair of disposable plastic gloves can protect if chances of contact with body fluids.



Wash your hands properly and kill germs especially in (case of infants, ICV, Dialysis, burns unit.



Proper disposable of Bio medical waste.

### Storage and distribution: -

- Cup boards, selves, tables, chairs, racks.
- Trolleys, Instrument trays, wire baskets and containers.

6. Infection Control



Honey is a natural reservoir for the botulism bacteria. which is cause for food poisoning.

# 6.8 Bio medical waste management

### Introduction: -

All human activities produce waste which may be dangerous and needs safe disposal Industrial waste, Agricultural waste, Sewage waste Pollute



water, land and air. It can also be dangerous to human beings and environment. Similarly, hospitals and other health care facilities generate so many wastewhich spread lot of infection. It spread HIV, Hepatitis, Tetanus etc. mostly the health workers who handle in hospital.

India generates around three million tons of Bio medical waste per year and the amount expected to grow at 8% annually.

Bio medical waste is the waste which is generated by hospitals, nursing homes, clinic dispensaries, veterinary institution, animal house, pathological laboratory and blood bank and is not degradable.

### Classification of waste: -

### 1. General Waste: -

- a. General sweeping
- **b.** Packing material.
- **c.** Kitchen waste.

- d. Paper pieces
- e. Waste from laundry, wards and Laboratory.

### 2. Infectious waste: -

- a. Human anatomical waster (human tissue, organ, body parts)
- b. Microbiology and micro technology waster (Laboratory culture, stocks, attenuated vaccine research and industrial laboratories)
- c. Solid Waste (items contaminated with blood and body fluids including cotton, dressing, soiled plaster casts) beddings, linens, devices used for transfer of cultures.

### 3. Shapes: -

- a. Hypodermic needles, stitching needles, needles attached with tubing.
- **b.** Scalpel blades, razors, nails etc.
- **c.** Blood vials, cover slips, edges of slides

### Bio medical waste: -

Bio medical waste means any solid or liquid waste including its container and any intermediate product which is generated during the diagnosis, treatment or immunization of human being and animals.

Prompted improvements in medical technology and centralized Medicare brought huge volumes of toxic and hazardous waste.

Situation forced a serious rethinking and necessitated an appropriate refinement in preexisting legislation.

6. Infection Control

#### Sources:

- Hospitals
- Medical research laboratories
- Vaccinating centers
- Slaughter house
- Animal houses
- Bio technology institution

#### Types of biomedical waste: -

- Human anatomical waste like tissues, organs and body parts.
- Waste from hospitals like needles, syringes, scalpels, and broken glass.

#### Segregation, Packing, Transporting: -

- **1.** Biomedical waste shall not be mixed with other waste.
- 2. Biomedical waste shall be segregate into containers bags at the point of generation prior to its storage, transportation, treatment, and disposal. The containers shall be labeled.

- **3.** Untreated biomedical waste shall be transported only by the competent authority as specified by the government.
- **4.** The authorized person must take permission of the prescribing authority to take measure to ensure that the waste does not adversely affect human health and the environment.

# Measures to minimize health risk due to medical waste: -

- i. Use appropriate protecting clothing like gloves.
- ii. Popularize use of color and emblem code on container bags
- iii. Constitute a hospital acquired infection control committee.
- iv. Incinerator
- v. Confirms to pollution control board norms.
- vi. Segregation of waste from hospitals is transport and disposes it.





6. Infection Control

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# 6.9 Central sterile service department (CSSD): -

CSSD is also called sterile processing, on central supply department is an integrated place in hospitals and health care facilities that performs sterilization and other actions on medical devices, equipment and consumable.

It is also for subsequent use by health workers in the operating theatre of the hospital and also for other aseptic procedures.

**E.g. Catheterization, wound stitching and bandaging**. In a medical, surgical and maternity or pediatric ward.

### **CSSD Divisions: -**

CSSD is divided into five major areas.

- i. Decontamination
- ii. Assembly & Processing
- iii. Sterilizing

- iv. Sterile storage
- **v.** Storage

### FUNCTION AND ACTIVITIES OF CSSD

### Definition: -

CSSD as that service, with in the hospital catering for the sterile supplies to all departments both to specialized units as well as general wards in OPDS.

### AIM:

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- Centralizing the activities of receipt, cleaning, assembly, sterilization, storage and distribution of sterilized materials from a CSSD.
- Safe sterilization is done under controlled condition with technical supervision at an optimum cost.
- To provide an efficient, continuous and quality supply of sterilized material to hospital in various areas and infection free patient care.
- Contributes to reduction in hospital infection.
- To reduce the burden of work of the nursing personnel, thereby enabling them to devote more of their time to patient care



### Advantages:

- Processing issue and control
- Infection free atmosphere
- Economic efficient and uniform source
- Maintains Standards
- Reduces burden on nursing staff
- Prevents cross infection
- Shortens patients stay
- Ensures safe environment
- Inventory maintenance & quality one.

### **Objectives And Functions Of CSSD:-**

- To provide supplies of sterile linen packs basins, instruments other sterile items.
- To maintain an accurate record of the effectiveness of the cleaning, disinfecting and sterilizing process
- To monitor and enforce control necessary to prevent cross infection

#### **Basic Division in CSSD: -**

according to infection control policies.

- To review current practice for possible improvement in quality or service provided.
- To provide consulting services to other departments in all areas of sterile processing.
- CSSD is the hospital central nervous system where the battle against infection takes place.

### Planning Of CSSD



CENTRAL UNIT PERIPHERAL UNIT

Responsible for receiving dirty utilities and mainly responsible for distribution to various areas of hospitals (TSSU)

I	II	III	IV	V	VI
Cleaning	Drying Area	Packaging	Sterilization	Storage Area	Issue Counter
Area		Area	Area		

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### Equipment: -

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- I. Cleaning area: -
  - **1.** High capacity pass through washer disinfector at 80C to 90C having various shapes and sizes
  - 2. Cold and hot water streams
  - **3.** Detergent solution
  - **4.** Hot air oven for drying instruments.
  - **5.** Wall fixtures for drying.

### **II.** Sterilization area: -

- **1.** Autoclaves using dry heat, moist heat.
- **2.** Ethylene oxide sterilizers.

6. Infection Control

### Student Activity

Make a posters in the classroom – how does an infectious disease spread

YOU KNOW? Sleep is very important for a person's immune system. If a person does not get enough sleep every night their immune system will collapse.

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### 👌 SUMMARY

Infection control is the discipline concerned with preventing Nosocomial or health care associated infection. It is the practical sub discipline of epidemiology. Practices that control and prevent transmission of infection help to protect patients and workers health from disease.

Knowledge of microbiology is an essential component in nursing for practising this infection sterilization to eliminate pathogenic microbes causing infection disease.

A complete network of specialized cells, tissues, organs that recognize and defend the body from foreign substances. The ability of the host to resist a particular infection or toxin by the action of specific antibodies sensitized white blood cells produced by them in response to natural exposure of the organism is immunity.

Microbial identification is necessary to know the disease and its specific treatment by morphology, resistance, biochemical test, immunological test.

Infection is the invasion or colonization of the body by pathogenic microorganism. The surgical instruments and operation theatres is cleaned by sterilization process and some disinfection agents. if the organism overcome the defense of the host development of the disease follows a certain sequence of steps.

Universal precaution is an approach to infection control to treat all human blood and certain human body fluid (HIV, Hepatitis B). Biomedical waste management is mandatory technique in hospital. Because these waste things may cause so many hazardous to the environment. Segregation of waste from hospital is transport and proper disposable is needed. CSSD as that service within the hospital for the sterile supplies to all departments.



#### I. Choose the correct answer

- 1. What type of immunity can develop by the administration of vaccine?
  - a) Artificial passive immunity
  - b) Artificial active immunity
  - c) Natural active immunity
  - d) Natural passive immunity
- 2. Which is live attenuated type of vaccine?

d) HepA

- a) DPT b) OPV
- c) BCG

 The organism which most involved in urinary tract infection.



- a) Salmonella b) E.coli
- c) Staphylococcus d) Shigella.
- 4. Ear infection (otitis media) is caused by
  - a) Streptococcus pyogenes
  - b) Streptococcus pneumonia
  - c) Mycobacterium sps
  - d) Salmonella typhi

6. Infection Control

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5. The ultra structure of the viruses can be seen by

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- a) Dark field microscope
- b) Electron microscope
- c) Phase contrast microscope
- d) Flourescene microscope.
- 6. The motility of the bacteria can be seen by
  - a) Staining method
  - b) Hanging drop method
  - c) Bio chemical test
  - d) Serological test.
- 7. The confirmatory test for HIV infection is
  - a) RIA b) ELISA
  - c) VDRL d) WESTERN BLOT
- 8. The antibody which is mostly present in secretions like tears, saliva, milk.
  - a) Ig A b) IgM
  - c) Ig G d) IgE
- 9. The temperature which is employed in moist heat sterilization for autoclaving method
  - a) 151°C 1 hour
  - b) 121°C for 15-30 minutes
  - c) 160°C 1 hour
  - d) 140°C for 30 minutes.
- 10. The temperature which is employed in hot air oven
  - a) 280°C 1hour
  - b) 160°C for 1 hour
  - c) 150°C 2hour
  - d)  $180^{\circ}$ C for 30 minutes.

- 11. In which of the following is non ionizing radiation?
  - a) Gamma rays b) X-rays
  - c) Cosmic rays d) UV rays
- 12. In which stage the appearance of mild signs and symptoms and capable of spreading disease is.
  - a) Incubation period
  - b) Prodromal stage
  - c) Period of decline
  - d) Convalescence stage
- 13. The patient acquire infection during therapeutic procedure is
  - a) Nosocomial infection
  - b) Iatrogenic infection
  - c) Endogenousinfection
  - d) Exogenous infection.

# II. Answer the following questions in one (or) two lines.

- 14. Define immunity.
- 15. What is innate immunity? Give example
- 16. What is adaptive immunity? Give example
- 17. What is vaccine? give examples.
- What is inactivated or killed vaccine? give examples.
- 19. What is infection? Write any two types.
- 20. What is antiseptic agent? give examples.
- 21. What is an antigen?
- 22. What is antibodies? and its types.
- 23. What is sterilization?

6. Infection Control

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### III. Write short notes

- 24. What is antibiotics?
- 25. What is incubation Period?
- 26. Write about the types of adaptive immunity.
- 27. List out the organism involved in respiratory tract infection.
- 28. Write any two types of sterilization process in moist heat method.
- 29. List the types of microscope.
- 30. Write about the methods of dry heat sterilization.
- 31. Write about the types of rays involved in sterilization Process.
- 32. What are the stages involved in stages of Infection?
- 33. List the types of Infection.
- 34. What is Fumigation? With example.
- 35. What is Pasteurization?

- Write about the divisions and aims of CSSD .
- 37. What is Bio-medical waste management?

### **IV. Write in detail**

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- 38. Explain the types of Immunity.
- 39. Write in detail about the types of vaccine.
- 40. Explain the infection process.
- 41. Write about the course of infection.
- 42. Write in detail about the moist heat sterilization.
- 43. Write about the defence against infection.
- 44. Write the need for universal precaution.
- 45. Explain the classification and disposal of Bio-medical waste.
- 46. Explain the Objective, Planning, functions and activities of CSSD.

### A-Z GLOSSARY

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- 1. Antiseptic (கிருமி நாசினி) a chemical agent used in antisepsis
- Anti asepsis (சீழ்த்தவிர்ப்பு) the destruction of microorganism on living tissue having preventing the infection
- 3. Carrier (கடத்தி) a person who harbours a specific infectious agent in the absence of clinical disease
- Colonization (நுண்ணுயிரிகளின் வளர்ச்சி) the presence of organism in a particular site without any symptoms
- 5. Flora (உடல் நுண்ணுயிரிகள்) microorganism resident is an environment or body site

116

6. Infection Control

6. Nosocomial infection (நோசோகோமியல் தொற்று) – infection acquired during hospitalization

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- 7. Incubation period (இன்குபேஷன் காலம்) the time interval between initial contact with entry of organism and the appearance of first signs or symptoms
- 8. Reservoir (தேக்கம்) a place where microorganism are growing or have grown
- 9. Sterilization (நோய் நுண்மங்கள் ஒழிக்கப்பெற்ற) a process which renders an item sterile
- 10. Susceptible (பாதிக்கப்படுகின்ற நிலை) a person not possessing sufficient resistance against a pathogenic agent
- 11. Virulence (நச்சுத்தன்மை) a degree of activity of pathogenic microorganism

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- Text book of medical and surgical nursing author: Brunner and Suddarth 12<sup>th</sup> edition
- Text book of microbiology "Ananthanarayanan and panikar's edited by CKJ panikar 7<sup>th</sup> edition
- Text book of immunology benjamini coico sunshine wiley- liss publication 4<sup>th</sup> edition

### 💽 INTERNET LINKS

- http://medlineplus.gov>infectioncontrol
- https://www.cdc.gov
- http://m.youtube.com>watch