

# **INFECTIONS**

MICROBIOLOGY – III

BVOC – HCT

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# Introduction

- An **infection** is the invasion of an organism's body tissues by disease-causing agents, their multiplication, and the reaction of host tissues to the **infectious** agents and the toxins they produce.
- **Infectious diseases** are **disorders** caused by organisms — such as bacteria, viruses, fungi or parasites.
- Many organisms live in and on our bodies. They're normally harmless or even helpful. But under certain conditions, some organisms may cause **disease**.
- A **disease** is a particular abnormal condition that negatively affects the structure or function of all or part of an organism, and that is not due to any immediate external injury. Diseases are often known to be medical conditions that are associated with specific symptoms and signs.

➤ SAPROPHYTE

- Free-living microbes that live on dead or decaying matter.

➤ PARASITE

- Microbes that can establish themselves and multiply in hosts

➤ Commensal

- Microbes that live with the host in complete harmony without causing any damage.

- Eg. *Streptococcus salivarius*

- *E. coli*

➤ Opportunistic pathogen

- Pathogen that is normally safe but when host's immunity is lowered, they can be dangerous.

- *Candida albicans*

- *Streptococcus sp.*

# Types of infection

- Primary
- Reinfection
- Secondary
- Focal infection
- Nosocomial infection
- Iatrogenic infection
- Endogenous
- Exogenous
- Inapparent/subclinical
- Atypical
- Latent
- Local
- Generalized

➤ **Primary infection**

- Exposure of pathogen for the first time

➤ **Reinfection:**

- Exposure of the same pathogen for second or many times.

➤ **Secondary infection:**

- Infected by a pathogen, immunity lowered and cause invasion by other pathogen

➤ **Localized infection:**

- An infection may be restricted to the point of entry

➤ **Generalized infection:**

- An infection may spread throughout the body.
- Ex. Bacteraemia, septicaemia and pyaemia are some of the generalised infections which spread through blood

- **Bacteraemia:** is defined as the circulation of bacteria in the blood.
- **Septicaemia:** This is a condition in which bacteria circulate and multiply in the blood, form toxic products and cause high swinging type of fever.
- This can be due to both endotoxin (*Salmonella*) as well as exotoxin (*Clostridium tetani*) producing organisms.
- **Pyaemia:** This is a condition in which pyogenic bacteria (*Staphylococcus aureus*) produce septicaemia with multiple abscesses in internal organs such as liver, spleen and kidney.

➤ **Nosocomial infection:**

- A person make a hospital visit, immunity is low, and get infected by hospital microbes. Eg: wound sepsis.

➤ **Iatrogenic infection:**

- Drug induced infection during course of treatment.
- Eg: muscle sepsis caused by unsterilized equipment used.

➤ **Endogenous infection:**

- When a commensal enter places it should not be.
- Eg: entrance of *E. coli* to urinary tract cause infection.

➤ **Exogenous infection:**

- When a pathogen comes from othersource
- Eg: soil

- **In apparent /subclinical**

- Asymptomatic

- **Atypical infection**

- Symptoms are atypical. Ex. atypical pneumonia

- **Latent infection**

- Parasites remains in tissues in latent or hidden form, proliferating and producing clinical disease when the host resistance is lowered.

- Eg: herpes infection

- **Systemic infection:**

- Spread throughout the body

- Eg: *Streptococcus* infection



## **Sources of Infection:**

- Human beings
- Animals
- Insects
- Soil and water
- Food

### **Human beings:**

- The commonest source of infection for human beings is human beings themselves. The parasite may originate from a patient or carrier.
- Humans play a substantial role as microbial reservoirs.
- Ex: Tuberculosis by coughing; and the common cold through sneezing

## **Carrier:**

- a person who harbours the pathogenic microorganism without suffering any ill effect because of it.

## **Types of carrier**

- Healthy carrier - never get infected.
- Convalescent carrier- the one that recovered from the disease.
- Temporary carrier - <6 months.
- Chronic carrier - several years or the rest of the life.
- Contact carrier - someone who acquires pathogen from a patient.
- Paradoxical carrier - someone who acquires pathogen from a carrier.

- **Animals:**
- Many pathogens are capable of causing infections in both human beings and animals.
- Animals may act as a source of infection of such organisms.
- They serve to maintain the parasite in nature and act as reservoir and they are, therefore, called reservoir hosts.
  
- **Zoonoses** - infectious disease transmitted from animals to humans.
- types:
  - Bacterial (plague from rats)
  - Viral (rabies from dogs)
  - Protozoal (toxoplasmosis from cats)
  - Helminthic (hydatid disease from dogs)
  - Fungal (zoophilic dermatophytes from cats and dogs)

- **Insects:**
- Blood-sucking insects such as mosquitoes, ticks, mites, flies, and lice may transmit pathogens to human beings and diseases so caused are called arthropod-borne diseases.
- Vectors :Insects that transmit infections are called vectors. Ex. mosquitoes, ticks, mites, flies, fleas, and lice.
- Types of vectors:
- **Mechanical vectors:** The disease agent is transmitted mechanically by the arthropod. Carriage is passive, with no growth of the pathogen during transmission.
- Ex: transmission of dysentery by flies.
- **Biological vectors:** are those in whom the pathogens multiply or undergo developmental changes with or without multiplication
- Ex. Anopheles mosquito in malaria
  - “*Extrinsic incubation period*”
    - Time of entry of the pathogen into the vector and the vector becoming infective.

## **Soil:**

- Some pathogens can survive in the soil for long periods.
- Fungi (eg: *Histoplasma capsulatum*) and parasites (eg: hookworm, roundworm)
- Spores of tetanus and gas gangrene

## • **Water:**

- Water may act as the source of infection either due to contamination with pathogenic microbes
- Eg: *Vibrio cholera*, *Salmonella*, *Shigella*, infective hepatitis virus

## • **Food:**

- Contaminated due to external contamination or pre- existent infection in meat or the animal product.
- Contaminated food may act as source of infection of organisms causing food poisoning, gastroenteritis, diarrhea and dysentery. There are two primary types of food-related diseases: foodborne infections and food intoxicants.

## **Mode of transmission**

- The human host may acquire microbial agents by various means referred to as the modes of transmission. Pathogenic organisms can spread from one host to another by a variety of mechanisms. These include:
  - 1. Contact
  - 2. Inhalation
  - 3. Ingestion
  - 4. Inoculation
  - 5. Insects
  - 6. Congenital
  - 7. Iatrogenic and laboratory infections

## 1. Contact

- Infection may be acquired by contact, which may be direct or indirect.
- Direct contact :
- Direct contact implies an actual physical interaction with the infectious source.
- Ex: STD - syphilis, gonorrhea, AIDS.
- Indirect contact—fomites :
- Indirect contact may be through the agency of fomites.
- **Fomites** are inanimate objects such as clothing, pencils or toys which may be contaminated by a pathogen from one person and act as a vehicle for its transmission to another.
- Ex: thermometers, eating utensils, drinking cups, and bedding.

## 2. Inhalation

- **Droplet nuclei:**
- Droplet nuclei are usually 1-10 mm in diameter which remain suspended in the air for long periods, acting as sources of infection.
- Respiratory infections such as common cold, influenza, measles, mumps, tuberculosis and whooping cough are acquired by inhalation.
- Such microbes are shed by the patients into the environment, in secretions from the nose or throat during sneezing, speaking, coughing and other forceful expiratory activities.
- **Dust :**
- Larger droplets (0.1 mm) which are expelled during talking, coughing or sneezing
- Settle down by their sheer weight on the floor, carpets, furniture, clothes, bedding, linen and other objects in the immediate environment and become part of the dust.
- Ex: Pneumonia, tuberculosis.



### **3. Ingestion**

- Intestinal infections are generally acquired by the ingestion of food or drink contaminated by pathogens.
- Infection transmitted by ingestion may be waterborne (cholera), foodborne (food poisoning) or handborne (dysentery).

### **4. Inoculation**

- The disease agent may be inoculated directly into the skin or mucosa.
- Ex: Rabies virus, tetanus spores, insect vectors.
- Infection by inoculation may be iatrogenic when unsterile syringes and surgical equipment are employed.
- Ex: Hepatitis B and HIV.

## 5. Insects

- Vectorborne :
- In infectious disease epidemiology, vector is defined as an arthropod or any living carrier (e.g. snail) that transports an infectious agent to a susceptible individual.
- In some diseases, blood-sucking insects play an important role in the spread of infection from one individual to another.
- Ex: Mosquito – malaria, dengue.
- House fly - Typhoid and paratyphoid fever, diarrhea, dysentery, cholera
- Transmission by a vector may be mechanical or biological.

## **6. Congenital**

- Vertical Transmission:
- Some pathogens are able to cross the placental barrier and reach the fetus in utero. This is known as vertical transmission.
- Vertical transmission may result in abortion, miscarriage or stillbirth. Live infants may be born with manifestations of a disease
- Ex: Congenital syphilis

## **7. Iatrogenic and Laboratory Infections**

- If meticulous care in asepsis is not taken, infections may be transmitted during administration of injections, lumbar puncture and catheterization.
- These are known as iatrogenic or physician-induced infections
- Ex: AIDS and hepatitis B .

## Portals of entry:

To produce infection in man a microbe has to gain entry into the host.

The most frequent portals of entry are:

- respiratory tract (by inhalation)
  - gastrointestinal tract (by ingestion)
  - breaks in the superficial mucous membranes and skin (direct contact).
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- From the portal of entry the parasite may spread directly through the tissues or
  - May proceed via lymphatic channels to the blood stream
  - Distributes it widely and permits it to reach tissues particularly suitable for its multiplication.

## **Types of infectious disease**

- Endemic-constantly present in particular area.
- Epidemic- spreads rapidly and infect many persons in an area at a time.
- Pandemic- epidemic that spreads through many areas of the world, very large number of persons in short period.
- Prosodemic- creeping and smouldering epidemics
- Sporadic – seen only occasionally usually w/o geographic concentration.