

Introduction to parasitology

Host-parasite relationships:-

Symbiosis: the relationship between living organisms that live together, there are different types of these relationships

1- **Mutualism** is the relationship between two organisms in which both of them depend on each other physiologically. Ex. termite-protozoa relationship, the termite feeds on cellulose but its own digestive enzymes are incapable of digesting it. Protozoa living in termite digestive tract have the ability to do so. Thus termite gets benefits by digesting its food and the protozoa at the same time get nutrition, multiplication, protection, suitable environment for living and shelter. So this association is helpful both to parasite and host.

2- **commensalism** is the relationship in which one organism benefit and host remains unaffected. Ex. *Entamoeba coli* inhabits the intestinal tract of human so gets nutrition, protection, suitable environment for living but does not cause any pathogenic effects for the host.

3- **parasitism** in this case one organism gets benefit but the host is affected .

Medical parasitology deals with the parasites which cause human infections and the diseases they produce. Parasitism is a strong and intimate association in which the parasite established itself in or on the living body of the host, being physically and physiologically dependent on it for at least part of its life cycle.

A parasite is an organism which has become adapted to living on or in some other organism, which is usually larger than itself. The relationship between any two living things in which each of them depends on the other physiologically. The first (symbiont) is the organism that lives inside the body of the second (host) is the organism or the body in which the symbiont lives.

Parasites which live in complete harmony with the host , without causing any damage to it are called commensals ,while those which cause disease are called pathogens.

Types of parasites

- ❖ Endoparasites:- the parasite lives inside the body of the host, ex. Malarial parasite ,Ascaris, Taenia saginata, Hydatid cyst.....

- ❖ Ectoparasites:- this type of parasite live outside (on the surface of) the host as on the skin (inhabits the body surface only without penetrating into the tissues) ex. mosquito, fleas, flies, scabies, lice and other haematophagous arthropods. They are important as vector transmitting pathogenic microbes. The term **infestation** is often employed for parasitisation with **ectoparasite** in place of the term **infection** used with reference to **endoparasite**.
- ❖ Obligatory parasites :- this parasite which cannot live without the host such as malaria, *Taeniasaginata* and other helminthes.
- ❖ Facultative parasites:- this type of parasite that accidently infest the host ex. Larval stage of house fly inside the ear ,this occur due to the discharge inflammatory pus which attracts flies to feed on and the latter may accidentally lay their eggs in the ear.
- ❖ Permanent parasite :- the parasite that remain in the host permanently ex. *Taenia saginata* which may live inside the body for long period may reach to 10 years or more.
- ❖ Temporary parasite :-the parasite that comes to the host for short time to obtain nutrition and leaves away ex. Mosquito, flies.
- ❖ Pseudoparasite :- a false parasite may be either commensal or temporary parasite in which accidentally ingested and leaves the host without causing any harmful effect.

Types of hosts:-

- ❑ Final host :- the host in which the parasite lives and reaches maturity, sometimes called definitive host ex. Human for *Taenia saginata* , *Ascaris*.
- ❑ Intermediate host :- the host in which larval stage of the parasite lives or the asexual multiplication takes place for continue their life cycle ,so some parasite need intermediate host while others not ex.cow for *T.saginata* and snails for schistosomal parasites. Some parasites require tow intermediate hosts for complete their life cycle such as *P. westermani*and *D. latum*.

- ❑ Reservoir host :-the host in which the parasite can be found or develops an asymptomatic infestation until it travels to its own intermediate or final host . Ex. dogs and rodents in human leishmaniasis.
- ❑ Transport host or vector :- an organism that transmit the parasite by mechanical process without development of the parasite inside it ex. House fly. Also named as paratenic host

Sources of infection:-

Parasitic infections originate from various sources and are transmitted by various routes, the major sources of infection are:-

1- Soil :-

- Embryonated eggs which are presented in soil may be ingested ex. Round worm, whipworm.
- Infective larva present in soil may enter by penetrating exposed skin, ex. Hook worms.

2- Water :-

- Infective forms of some parasite present in the water may be swallowed ex. cyst of amoeba and Giardia.
- Water containing the intermediate host for some parasite and may be swallowed ex. Infection with Guinea worm occur by drinking the water containing the Cyclops which is the intermediate host for this parasite.
- Infective larva in water may enter by penetrating exposed skin ex. Cercariae of schistosoma.
- Free-living parasite in the water may enter through vulnerable sites ex. Naegleria may enter through nasopharynx and cause meningoencephalitis.

3- Food:-

- Contamination with human or animal feces ex. Amoebic cysts, eggs of helminthes.
- Meat containing infective larva ex. *Taeniasaginata* and *Trichinellaspiralis*.

4- Insect vectors:-if the transmitter is not essential in the life cycle , called mechanical vector whereas if it's essential in the life cycle, it is a biological vector.

- Biological vector, ex. Mosquito in the life cycle of malaria and sand flies in the life cycle of *leishmaniadonovani*.
- Mechanical vector, ex. house fly in the transmission of amoebiasis.

5- Animals:-

- Cow in the life cycle of beef tapeworm.
- Dog in the life cycle of hydatid disease.
- Cat in the toxoplasmosis.
- Mollusks in the life cycle of liver flukes.

6- Other persons:-

Carriers and patients , ex. all anthroponotic infections, vertical infection (congenital infection).

7- Self-(autoinfection):- ex. finger to mouth transmission such as in the pin worm or internal reinfection such as in the strongyloides.

❖ Transmission of parasites

- Most of the parasites adopt a specific mode of entry to gain access to the host. Though there are various modes of entry, ingestion and inoculation are two primary routes of transmission of infection to man. Apart from this, congenital, venereal, inhalation and other unusual routes are employed by the parasites to enter human body.
- Entry of parasite is called as infection whereas clinical manifestations are given the name of disease.
- The period of incubation is the time interval between the actual infection and the first appearance of any clinical feature. This is usually followed by prodromal period which is characterized by general features of disease such as headache, malaise, etc. and is short in duration.

Modes of infection :-

The major mode of infection are :-

- 1- Oral transmission:- ex. *Entamoeba histolytica*.
- 2- Skin transmission:- ex. Schistosomiasis.
- 3- Vector transmission:- ex. Malarial infection.
- 4- Direct transmission :- ex. in the trichomoniasis
- 5- Vertical transmission:- ex. Toxoplasmosis

❖ attribute of pathogenic parasites

The parasites damage the host tissue by following mechanisms:

- **1-Direct physical and chemical damage**

A-Intracellular parasites usually kill the host cell within which they multiply.

b- Some protozoa release cytolytic enzymes on contact with host cells e.g. *Entamoeba histolytica* and *Balantidium coli* infection.

c- Through vascular blockage as in *falciparum* malaria.

d- Intestinal obstruction as in *Ascaris* infection.

e- Mechanical pressure e.g. hydatid cyst can compress the biliary tract by external pressure.

f- Direct damage to the mucosal surfaces by the worms e.g. hookworms.

g- through irritant effect of large worms in the gut.

- **2-Damage by immunological mechanisms:** Damage through inflammation as a result of rupture of parasitized cells or by immunological mechanisms.

- **3-Induction of neoplastic changes**

- Only two human cancers are known to be caused by parasites.

- *Clonorchis* and *Opisthorchis* flukes can cause cholangiocarcinoma originating in the bile ducts.

- *Schistosoma haematobium* can initiate squamous cell bladder carcinoma.

❖ Laboratory diagnosis

- **Direct demonstration of adult parasite**

- Detection of adult worm of *Ascaris* in the stool sample is very common. Pinworms can be seen in perianal swabs and an emerging guinea worm leaves no doubt about the diagnosis.

- **Microscopic examination of body fluids and excreta**

- **Blood:** There are various ways in which blood can be examined:

- -Thick and thin blood film like *Plasmodium*, *Leishmania*, *Trypanosoma*, *Babesia*

- -Wet blood film like *Trypanosoma*, *Microfilaria*

- Buffy coat preparation like *Trypanosoma*, *Leishmania donovani*

- Membrane filtered blood like *Microfilaria*

❖ Stool: Wet preparation

- **Trophozoite in saline preparation**

- **Cyst and ova in iodine preparation**
- **Permanent stained preparation**
- **Concentration methods**
- **Urine:** The principal parasitological finding in the urine is that of the eggs of *Schistosoma haematobium*. *Trichomonas vaginalis*, microfilariae of *Wuchereria bancrofti* and *Onchocerca volvulus* may be detected.
- **Perianal and vaginal swabs:** Perianal swab is the usual method for collection of *Enterobius* whereas eggs of *Taenia saginata* are common on perianal skin. *Trichomonas vaginalis* and rarely trophozoites of *Entamoeba histolytica* are detectable from vaginal swabs.
- **Sputum:** Eggs of *Paragonimus*, larvae of *Strongyloides*, larvae of *Ascaris*, protoscolices and brood capsules of hydatid cyst and *Entamoeba gingivalis*. These parasite are suspected in sputum sample.
- **Duodenal aspirate and CSF:** Duodenal aspirate is collected for the demonstration of trophozoites of *Giardia lamblia* and eggs or larvae of *Strongyloides stercoralis*. CSF is examined for *trypanosomes* and free living amoebae.
- **Tissues:** Examination of wet tissue specimens can sometimes yield valuable diagnostic information about the parasitic diseases.
- **Culture:** Culture methods are not developed considerably and extensively for parasites. Some parasites can be cultured now like *Entamoeba histolytica*, *Leishmania* sp., *Blantidium coli*, *Schistosoma*, *Trichinella*, *Onchocerca*.
- **Xenodiagnosis:** This methods employs an intermediate host or vector, within which the parasite multiplies, to detect low level of parasitism.
- **Animal inoculation:** A few important parasitic disease can be diagnosed by this method like *Leishmania donovani*, *Toxoplasma gondii*, *Babesia*.
- **Histopathology:** Tissue cysts due to *Trypanosoma cruzi* and *Sarcocystic* can be easily demonstrated in stained tissue sections.
- **Immunodiagnosis :**Two tests are in practice: *Leishmania* test is a delayed type of hypersensitivity reaction which is very sensitive and specific. Casoni test indicates diagnosis of hydatid disease.
- **Radiological and scanning techniques:** Some helminthes s calcify in human body and produce opacitie on radiological examination.

These include: *Dracunculus*, *Loa loa*, *Echinococcus*, *Taenia slium*, *Paragonimus*, *Schistosoma haematobium*.

- **Molecular techniques:** Various tests methods used are PCR, DNA probe . Molecular tests have been developed to increase the sensitivity and specificity of diagnosis of parasitic infections by way of amplification of the parasitic antigens which may not be detectable by conventional methods.

Classification of parasites

The parasites of medical importance fall into two kingdoms:

1- **Protista:** The microscopic, single-celled, eukaryotic (having true nuclear membrane) organisms . Which resemble yeast in their size and simplicity are designated as protozoa. The shape, size, mode of reproduction and type of locomotive organelle have been used to divide these into four major classes:

A- Rhizopodes(amoebae): Organelles of locomotion are pseudopodes and the reproduction by binary fission.

B- Flagellates: Organelles of locomotion are flagella and the reproduction by binary fission.

C- Ciliates: Organelles of locomtions are cilia and reproductions by binary fission.

D- Sporozoa: Without locomotion organelles and the reproductions by sporogony and shizogony.

2- **Animalia:** Helminths are macroscopic, multicellular worms possessing well- differentiated tissues and complex organ systems. These vary in length from less than one millimeter to more than a meter.

The common helminthic parasites of human being can be placed in one of the three classes on the basis of body and alimentary tract configuration, nature of the reproductive system and need for more than a single host species for the completion of life cycle:

A- Trematodes B- Cestodes C- Nematodes

