General Introduction

Medical Parasitology deals with the parasites which cause human infections and the diseases produce.

Parasites are organisms that infect other living beings.They live in or on the body of another living being, the *host and obtain shelter and* nourishment from it. They multiply or undergo development in the host.

Parasite is an organism that is entirely dependent on another organism, referred to as its host , for all or part of its life cycle and metabolic requirement .

Human parasites may be either unicellular Protozoa, or larger organisms multicellular (metazoa), some of which maybe many metres in size.

Parasite is a living organism, which takes its nourishment and other needs from a host.

Host is an organism which supports the parasite.

The parasites included in medical parasitology are protozoa, helminthes, and some arthropods.

The hosts vary depending on whether they harbor the various stages in parasitic development.

DIFFERENT KINDS OF PARASITES

- Ectoparasite – a parasitic organism that lives on the outer surface of its host, e.g.lice, ticks, mites etc.
- Endoparasites – parasites that live inside the body of their host, e.g. *E. histolytica.*
- Obligate Parasite - This parasite is completely dependent on the host during a segment or all of its life cycle, e.g. Plasmodium spp.
- Facultative parasite – an organism that exhibits both parasitic and non-parasitic modes of living , hence does not absolutely depend on the parasitic way of life, but is capable of adapting to it if placed on a host. E.g. *Naegleria fowleri*
- Accidental parasite – when a parasite attacks an unnatural host and survives. E.g. *Hymenolepis diminuta (rat tapeworm).*
- Erratic parasite - is one that wanders in to an organ in which it is not usually found.E.g. *Entamoeba histolytica in the liver or lung of humans.*

Most of the parasites which live in/on the body of the host do not cause disease(non-pathogenic parasites). In Medical parasitology we will focus on most of the disease causing (pathogenic) parasites.

The following are the three common symbiotic relationships between two organisms:

Mutualism -An association in which both host and parasite are so dependent upon each other one cannot live without the help of the other. One classic example is the relationship between certain species of flagellated protozoa living in the gut of termites.

Commensalism - an association in which the commensal takes the benefit without causing injury to the host. E.g. Most of the normal floras of the humans' body can be considered as commensals.

Parasitism - an association where one of the partners is harmed and the other lives at the expense of the other. E.g. Worms like *Ascaris lumbricoides reside in the* gastrointestinal tract of man, and feed on important items of intestinal food causing various illnesses.

- **Host** an organism which harbours the parasite and provides the nourishment and shelter to the Parasite. It is of following types :
- Definitive host – a host that harbors a parasite in the adult stage or where the parasite undergoes a sexual method of reproduction.
- Intermediate host harbors the larval stages of the parasite or an asexual cycle of development takes place. In some cases, larval development is completed in two different intermediate hosts, referred to as first and second intermediate hosts.
- Reservoir host a host that makes the parasite available for the transmission to another host and is usually not affected by the infection.
- Natural host a host that is naturally infected with certain species of parasite.
- Accidental host – a host that is under normal circumstances not infected with the parasite.
- A vector is an agent, usually an insect, that transmits an infection from one human host to another .

Sources of Infection

Parasitic infections originate from various sources and are transmitted by various routes. The major sources of infection are listed below:

Soil

A. Embryonated eggs which are present in soil may be ingested, e.g. roundworm, whipworm.

B. Infective larvae present in soil may enter by penetrating exposed skin, e.g. hookworm, strongyloides.

Water

A.Infective forms present in water may be swallowed, e.g. cysts of amoeba and giardia.

B. Water containing the intermediate host may be swallowed, e.g. infection with guinea worm occurs when the water that is drunk contains its intermediate host cyclops.

C. Infective larvae in water may enter by penetrating exposed skin, e.g. cercariae of schistosomes.

D. Free-living parasites in water may enter through vulnerable sites, e.g. Naegleria may enter through nasopharynx and cause meningoencephalitis.

Food

A. Contamination with human or animal feces, e.g. amoebic cysts. pinworm eggs,echinococcus eggs. toxoplasma oocysts.

B. Meat containing infective larvae, e.g. measly pork. *Trichinella spiralis.*

Insect Vectors

1. Biological vectors

A. Mosquito—malaria, filariasis B. Sandflies—kala-azar

C. Tsetseflies—sleeping sickness D. Reduviid bugs—Chagas' disease

E. Ticks—Babesiosis.

2. Mechanical vectors

A. Housefly—amoebiasis.

Animals

1. Domestic

A. Cow, e.g. beef tapeworm, sarcocystis. B. Pig, e.g. pork tapeworm, *Trichinella spiralis*

D. Dog, e.g. hydatid disease, leishmaniasis D. Cat, e.g. toxoplasmosis

- 2. Wild

  A. Wild game animals, e.g. trypanosomiasis.

  B. Wild felines, e.g. *Paragonimus westermani*

  C. Fish, e.g. fish tapeworm

  4. Molluscs, e.g. liver flukes

  5. Copepods, e.g. guinea worm.

  Other Persons

- Carriers and patients, e.g. all anthroponotic infections, vertical transmission of
- congenital infections.

  Self (autoinfection)

- a. Finger to mouth transmission, e.g. pinworm.
- b. Internal reinjection, e.g. strongyloides

Life cycle of human parasites

On the basis of their life cycles human parasites can be divided into three major groups:

-No intermediate host

Protozoa	helminthes
Ex *Entamoeba histolytica*	*Enterobius vermicularies*
Giardia lambelia	*Trichuris trichuria*

-One intermediate host

Intermediate host	parasite
Pig	*Taenia solium*
Mosquito	*Wuchereria bancrofti*

-Two intermediate host

Intermediate host	parasite
Snail, plant	*Fasciola spp.*

EFFECT OF PARASITES ON THE HOST

The damage which pathogenic parasites produce in the tissues of the host may be described in the following two ways;

(a) Direct effects of the parasite on the host

- **Mechanical injury** - may be inflicted by a parasite by means of pressure as it grows larger, e.g. Hydatid cyst causes blockage of ducts such as blood vesselsproducing infraction.
- **Deleterious effect of toxic substances-** in *Plasmodium falciparum production of* toxic substances may cause rigors and other symptoms.
- **Deprivation of nutrients**, fluids and metabolites -parasite may produce disease by competing with the host for nutrients.

(b) Indirect effects of the parasite on the host:

Immunological reaction: Tissue damage may be caused by immunologicalresponse of the host, e.g. nephritic syndrome following Plasmodium infections.

Excessive proliferation of certain tissues due to invasion by some parasites canalso cause tissue damage in man, e.g. fibrosis of liver after deposition of the ova ofSchistosoma.

Modes of Transmition

The major modes of transmission are the following:

1- Oral Transmission

The most common method of transmission is oral, through contaminated food, water,soiled fingers or fomites. Many intestinal parasites enter the body in this manner,Infection with*Entamoeba histolytica and other intestinal protozoa occurs when the infective cysts* are swallowed. In most intestinal nematodes, such as the roundworm. Whip worm or pinworm, the embryonated egg which is the infective form is swallowed. In trichinellosis and in beef, pork and fish tapeworm.

2- Skin Transmission

- Entry through skin is another important mode of transmission. Hookworm infection is acquired when the larvae enter the skin of persons walking barefooted on contaminated soil. Schistosomiasis is acquired when the cercarial larvae in water penetrate the skin. Many parasitic diseases, including malaria and filariasis are transmitted by blood sucking arthropods. Arthropods which transmit infection are called *vectors*

3-Vector Transmission

Parasites undergo development or multiplication in the body of true vectors, which are called ***biological vectors***. *Some arthropods may transmit infective parasites mechanically* or passively without the parasites multiplying or undergoing development in them are called ***mechanical vectors***. For example, the housefly may passive carry amoebic cysts from feces to food. *In the case of a mechanical vector there need be no delay between picking up* a parasite and transferring it to a host. A housefly picking up amoebic cysts from feces can within seconds transfer the cysts by landing on food being eaten by a person, who may thereby get infected. But in the case of biological vectors. A certain period has to elapse after the parasite enters the vector before it becomes infective. This is necessary because the vector can transmit the infection only after The parasite multiplies to a certain level or undergoes a developmental process in its body.

4-Direct Transmission

Parasitic infection may be transmitted by person-to-person contact in some cases;by kissing in the case of gingival amoebae and by sexual intercourse in trichomoniasis.Inhalation of air-borne eggs may be one of the methods of transmission of pinworm infection. Congenital infection (vertical transmission) may take place in malaria and toxoplasmosis. Iatrogenic infection may occur as in transfusion malaria and toxoplasmosis after organ transplantation.

CLASSIFICATION OF MEDICAL PARASITOLOGY

Parasites of medical importance come under the kingdom called animalia, Includes the microscopic single-celled eukaroytes known as protozoa. Incontrast,helminthes are macroscopic, multicellular worms possessing well differentiated tissues and complex organs belonging to the kingdom animalia.

- MedicalParasitology is generally classifiedinto:
- **Medical Protozoology** - Deals with the study of medically important protozoa.

- **Medical Helminthology** - Deals with the study of helminthes (worms) that affect man.

- **Medical Entomology** - Deals with the study of arthropods which cause or transmit disease to man.