

Al-Ma'Moon University College

Department of Medical Laboratory Technology

Medical Parasitology

Second Year

Lecture 1

م.م. رواء حيدر

2025-2024

Introduction

Medical parasitology is the study of parasites that infect humans, the diseases they cause, and the methods used to diagnose, treat, and prevent parasitic.

Classification of Medical parasitology:

1. Medical Protozoology ****Protozoa****: Single-celled organisms that can live inside or outside the host's cells. Examples include *Plasmodium* (which causes malaria), *Giardia* (which causes giardiasis), and *Leishmania* (which causes leishmaniasis).

2. Medical Helminthology ****Helminths****: Multicellular parasitic worms. These include roundworms (nematodes) e.g, tapeworms (cestodes), and flukes (trematodes).

The examples are *Ascaris lumbricoides* (roundworm infection), *Schistosoma* species (schistosomiasis), and *Taenia* species (tapeworms).

3. Medical Entomology ****Ectoparasites****: Parasites that live on the surface of the host. These include lice, mites, and fleas.

Association between Parasite and Host

A parasite: is an organism that lives on or within another organism called the host.

Host: is an organism that harbors the parasite, usually larger than the parasite.

Different kinds of Parasites:

- **Ectoparasite** : a parasitic organism that lives on the outer surface of its host e.g. lice, ticks, mites etc.
- **Endoparasite:** parasites that live inside the body of their host, e.g. *Entamoeba 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 and 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.

Different kinds of host:

- **Intermediate host:** the host harboring the larvae or asexual stage of parasite
- **Definitive host:** the host harboring adult or sexual stage of parasite
- **Reservoir host:** a host that makes the parasite available for the transmission to another host and is usually not affected by the infection.
- **Accidental host:** a host in which the parasite cannot develop successfully, but still can cause disease.

- **Paratenic host:** a host that serves as a temporary refuge and vehicle for reaching an obligatory host, usually the definitive host, i.e. it is not necessary for the completion of the parasites life cycle.
- **Natural host:** a host that is naturally infected with certain species of parasite.

Classification of Parasites

Each parasite belongs to a phylum, class, order, family, genus and species; the scientific designation of a parasite is binomial, a generic name (genus) and a specific name (species).

The parasites of humans in the phylum **protozoa** are now classified under three subphyla: **Sarcomastigophora** (containing the amoebae and flagellates); **Apicomplexa** (containing the sporozoan); and **Ciliophora** (containing the ciliates). The important human parasites are found within these great groups.

1. **Subphylum (Sarcodina)** is typically amoeboid and is represented in humans by class of *Entamoeba*, *Endolimax*, *Iodamoeba*, *Naegleria*, and *Acanthamoeba*.
2. **Subphylum Zoomastigophora**, the flagellates, have one or more whip-like flagella and, in some cases, an undulating membrane (e.g., trypanosomes). These include intestinal and genitourinary flagellates (*Giardia*, *Trichomonas*, *Dientamoeba*, *Chilomastix*) and blood tissue flagellates (*Trypanosoma*, *Leishmania*).
3. **Subphylum Sporozoa** undergoes a complex life cycle with alternating sexual and asexual reproductive phases, usually involving two different hosts (e.g., arthropod and vertebrate, as in the blood forms). The subclass

Coccidia contains the human parasites *Isospora*, *Toxoplasma*, and others. One of these, *Cryptosporidium*, has been implicated as a cause of intractable diarrhea among the immunosuppressed. Among the

Haemosporina (blood sporozoan) are the malaria parasite (*Plasmodium* species) and the subclass *Piroplasmia*, which includes *Babesia* species. *Pneumocystis* has recently been shown to be a member of the Fungi rather than the Protozoa. It is another opportunistic parasite of immunosuppressed individuals.

4. Subphylum Ciliata is a complex protozoan bearing cilia distributed in rows or patches, with two kinds of nuclei in each individual. *Balantidium coli*, a giant intestinal ciliate of humans and pigs, is the only human parasite representative of this group.

The Parasitic Worms, or helminths, of a human being, belong to two Subphyla:

1. Subphylum Platyhelminths (flatworms) lack a true body cavity (celom) and are characteristically flat in dorsoventral section. Medically important species belong to the classes **Cestoda** (tapeworms) and **Trematoda** (flukes). The tapeworms of humans are band-like and segmented; the flukes are typically leaf-shaped, and the schistosomes are narrow and elongate. The important tissue and intestinal cestodes of humans belong to the genera *Diphyllobothrium*, *Spirometra*, *Taenia*, *Echinococcus*, *Hymenolepis*, and *Dipylidium*. Medically important trematode genera include *Schistosoma*, *Paragonimus*, *Clonorchis*, *Opistorchis*, *Heterophyes*, *Metagonimus*, *Fusciolopsis*, and *Fasciola*.

2. Subphylum Nematelminths (worm-like, separate-sexed, insegmented roundworms) include many parasitic species that infect humans.

Symbiosis: Two different organisms live together and interact, The following are **the three common symbiotic relationships** between two organisms:

- **Mutualism:** an association in which both partners are metabolically dependent upon each other and one cannot live without the help of the other; however, none of the partners suffers any harm from the association. One classic example is the relationship between certain species of flagellated protozoa living in the gut of termites. The protozoa, which depend entirely on a carbohydrate diet, acquire their nutrients from 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.

Sources of infection refer to the origins or reservoirs from which infectious agents (such as bacteria, viruses, fungi, or parasites) are transmitted to hosts, causing disease. Common sources include:

1. Human-to-Human Transmission: - ****Direct contact**:** Physical contact with an infected person (e.g., shaking hands, hugging, kissing). ****Droplet**

transmission***: Coughing, sneezing, or talking expels droplets that contain infectious agents, which can infect others. - ****Sexual transmission****: Transmission through sexual contact (e.g., HIV, STIs).

2. Animal-to-Human Transmission (Zoonotic Infections): - ****Direct contact****: Handling or being bitten by an infected animal (e.g., rabies, avian flu). - ****Indirect transmission****: Contaminated animal products (e.g., unpasteurized milk or undercooked meat) or animal environments (e.g., farms, petting zoos).

3. Environmental Sources: - ****Water****: contaminated water sources (e.g., cholera, giardiasis). - ****Food****: Improperly cooked or contaminated food (e.g., salmonella, E. coli). - ****Soil****: Some organisms reside in soil (e.g., tetanus, anthrax).

4. Insect Vectors : ****Mosquitoes****: Spread diseases like malaria, dengue, and Zika virus. - ****Ticks****: Transmit infections like Lyme disease and Rocky Mountain spotted fever.

5. Healthcare-Associated Infections (HAIs): - ****Medical equipment****: Improperly sterilized instruments, catheters, or ventilators. - ****Healthcare workers****: Can carry infections between patients if proper hygiene protocols are not followed.

6. Fomites: Inanimate objects like door handles, towels, or clothing that become contaminated with infectious agents and serve as transmission vehicles.

Understanding the source of infection helps in its prevention and control.

Life cycle of parasites: is the process of parasite growth, development and reproduction which proceed in one or more different hosts depending on species of parasites. It can either be simple, when only one host is involved, or complex,

involving one or more intermediate hosts. A **parasite's life cycle consists of two common phases** one phase involves the route a parasite follows inside the body. This information provides an understanding of the symptomatology and pathology of the determined. The other phase, the route a parasite follows outside of the body, provides crucial parasite. In addition the method of diagnosis and selection of appropriate medication may also be information pertinent to epidemiology, prevention, and control.

Laboratory diagnosis: depending on the nature of the parasitic infections, the following specimens are selected for laboratory diagnosis:

- a) **Blood:** in those parasitic infections where the parasite itself in any stage of its development circulates in the blood stream, examination of blood film forms one of the main procedures for specific diagnosis. For example, in malaria the parasites are found inside the red blood cells. In **Bancroftian** and **Malayan filariasis, microfilariae** are found in the blood plasma.
- b) **Stool:** examination of the stool forms an important part in the diagnosis of intestinal parasitic infections and also for those helminthic parasites that localize in the biliary tract and discharge their eggs into the intestine. In protozoan infections, either trophozoites or cystic forms may be detected; the former during the active phase and the latter during the chronic phase. Example, **Amoebiasis, Giardiasis**, etc.
In the case of helminthic infections, the adult worms, their eggs, or larvae are found in the stool.
- c) **Urine:** when the parasite localizes in the urinary tract, examination of the urine will be of help in establishing the parasitological diagnosis. For example in urinary **Schistosomiasis**, eggs of **Schistosoma haematobium** are found in the

urine. In cases of chyluria caused by **Wuchereria bancrofti**, microfilariae are found in the urine.

d) Sputum: examination of the sputum is useful in the following:

- In cases where the habitat of the parasite is in the respiratory tract as in Paragonimiasis, the eggs of *Paragonimus westermani* are found.
- In amoebic abscess of lung or in the case of amoebic liver abscess bursting into the lungs, the trophozoites of *E. histolytica* are detected in the sputum.

e) Biopsy material: varies with different parasitic infections. For example spleen punctures in cases of kala-azar, muscle biopsy in cases of **Cysticercosis**, Trichinelliasis, and Chagas' disease, Skin snip for **Onchocerciasis**.

f) Urethral or vaginal discharge: for *Trichomonas vaginalis*.