PATHOGENIC MICROORGANISMS

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Lecture 2

Parasitology

Definition and General Information

Parasitology:- is a science that deals with interaction between parasites and their hosts.

Parasite:- is an organism living temporarily or permanently in or on another organism (host) from which is physically or physiologically dependent upon other. the term parasite refers to organisms, which belong to protozoa (i.e., Rhizopoda, flagellates, ciliates, sporozoans, and coccidians). Helminthes (Nematodes, Cestodes and Trematodes).

Association of Organisms

- When there is an association between two organisms their relation will be one of the following type:

1. Mutualism:- Mutual benefit is derived from the association.

2. Symbiosis:- Permanent association between two different organisms, so dependant on each other, that their life part is impossible.

3. Commensalism:- When the parasite benefited from the host while the host neither benefited nor harmed.

4. Parasitism:- is a close relationship between species, where one organism (the parasite) lives on or inside another organism (the host) causing it some harm, and is adapted structurally to this way of life.

Classification of Parasite

I. According to their habitat:

a. Ectoparasites*:* parasites living on or affecting the skin surface of the host. e.g. lice, tick, etc.

b. Endoparasites: Parasites living within the body of the host. e.g. *Leishmania* species, *Ascaris lumbricoides, etc.*

According to their dependence on the host:

1. Permanent (obligate) parasites: The parasite depends completely upon its host for metabolites, shelter, and transportation. This parasite can not live outside its host. e.g. *Plasmodium* species, *Trichomonas vaginalis,* etc.

2. Temporary (facultative) parasite**:** The parasite is capable of independent existence in addition to parasitic life. e.g. *Strongyloids stercolaris, Naegleria fowleri,* etc.

Types of Hosts

1. **Definitive host:-** Depending on the parasitic species, it is either a host which harbors the adult stage of a parasite or most highly developed form of the parasite occurs; or sexually mature stages of a parasite and fertilization takes place in it, e.g., human is the definitive host for trypanosomes.

2. **Intermediate host**:- Is a host harboring sexually immature or larval stage of a parasite and in which no fertilization takes place in it. e.g. Cow is the intermediate host for *Taenia saginata.*

3. **Reservoir host**:- A wild or domestic animal which harbors a parasite and acts as sources of infection to humans.

4. **Carrier host:-** A host harboring and disseminating a parasite but exhibiting no clinical sign.

5. **Accidental (Incidental) host:-** Host that harbors an organism that usually does not infect it.

Sources of Parasitic Infections

A. Contaminated soil:- Soils polluted with human excreta is commonly responsible for exposure to infection with *Ascaris lumbricoides,*

S.stercolaris, Trichuris trichuria and hook worms.

B. Contaminated water:- Water may contain

(a) Viable cysts of Amoeba, flagellates and *T. solium* eggs,

(b) Cercarial stages of human blood fluke.

C. Insufficiently cooked meat of pork and beef which contains infective stage of the parasite. *e.g., Trichenilla spiralis*, *Taenia* species.

D. Blood sucking arthropods:-These are responsible for transmission of: e.g.,

1. Malaria parasites by female anopheles mosquito

2. *Leishmania* by *phlebotomus.*

E. Animals (a domestic or wild animals harboring the parasite), e.g. dogs are direct sources for human infection with the Hydatid cyst caused by *Echinococcus granulosus.*

F. Sexual intercourse :- e.g., *Trichomonas vaginalis*

G. Autoinfection :- e.g., *S. stercoralis, Enterobius vermicularis.*

Medical Protozoology

Medical protozoology is a branch of parasitology that focuses on protozoa—single-celled organisms that can cause diseases in humans. Protozoa consists of a vast assemblage of single cell micro-organisms that are placed in the subkingdom, or phylum protozoa. They are made of a mass of protoplasm differentiated in to cytoplasm and nucleoplasm. The cytoplasm consists of ectoplasm and endoplasm. The ectoplasm function in protection, locomotion, ingestion of food, excretion, respiration. The endoplasm is concerned with metabolism. It contains the nucleus and many organelles.

Reproduction and maintenance of life is performed by the nucleus. The protozoa of medical importance to humans include Amoebas, Flagellates, Ciliates, Coccidia, sporozoa. Many protozoan species are not pathogenic.

Medical Helminthology

Medical helminthology is the study of helminths—parasitic worms that infect humans. Helminths are multicellular organisms with complex life cycles and various modes of transmission and infection. Helminths are parasitic worms that can infect humans and other animals. There are three types of helminths: flukes (trematodes), tapeworms (cestodes), and roundworms (nematodes). Adults can generally be seen with the naked eye. Many are intestinal worms that are soil-transmitted and infect the gastrointestinal tract. Other parasitic worms such as schistosomes reside in blood vessels.

The life cycles of helminths may be quite complex and include both direct and indirect cycles. The clinical sign and symptoms of helminthic infections depend on the location of the organisms and may be caused by adults, larva, or eggs.

Diagnosis

Diagnosing parasitic infections involves various methods depending on the type of parasite, the stage of infection, and the affected body system. There are more than one diagnostic technique used for different types of parasites such as:-

A. Protozoa

1- Microscopy

- **Direct Microscopy**: Examination of stained smears or wet mounts of blood, stool, or other body fluids under a microscope. Useful for diagnosing malaria (blood smears) and amoebic dysentery (stool).

2- Rapid Diagnostic Tests (RDTs)

- **Malaria**: Detect specific antigens from *Plasmodium* spp. in blood samples.

3- Polymerase Chain Reaction (PCR)

- **Specific Detection**: Identifies protozoan DNA in blood, stool, or other samples. Used for malaria, leishmaniasis, and Toxoplasmosis.

4- Serology

- **Antibody/Antigen Detection**: For detecting specific antibodies or antigens related to protozoan infections. Useful for Toxoplasmosis and leishmaniasis.

5- Imaging Studies

- **Ultrasound/CT/MRI**: For detecting cysts or lesions, particularly in conditions like Toxoplasmosis.

B. Helminths

1- Stool Examination

- **Microscopic Examination**: Identifies eggs, larvae, or adult worms in stool samples. Common for nematodes, trematodes, and cestodes.
- **Concentration Techniques**: Such as the formalin-ethyl acetate concentration method to increase the detection of low-density eggs.

2- Serology

- **Antibody/Antigen Tests**: For detecting specific antibodies or antigens related to helminthic infections. Useful for diagnosing strongyloidiasis and schistosomiasis.

3- Imaging Studies

- **Ultrasound/CT/MRI**: For visualizing cysts or lesions caused by helminths like *Echinococcus* spp. (hydatid disease) and *Taenia solium*

4- Biopsy

- **Tissue Biopsy**: Sometimes used to confirm the presence of helminthic larvae or cysts in tissues, like hydatid disease and trichinosis.

C. Ectoparasites

1- Direct Examination

- **Visual Inspection**: Identifies adult parasites or larvae on the skin or hair. Common for lice, fleas, and mites.
- **Skin Scraping**: For detecting mites like *Sarcoptes scabiei* (causing scabies).

2- Dermatological Tests

- **KOH Prep**: Potassium hydroxide (KOH) preparation can be used to identify fungal elements and some Ectoparasites in skin samples.

3- Serology

- **Antibody/Antigen Detection**: For some ectoparasitic diseases, such as certain flea-borne infections.

Antiparasitic Medications

The treatment of parasitic infections varies widely based on the type of parasite, the severity of the infection, and the affected organ systems.

A. Antiprotozoal Agents

- **Protozoa** (e.g., *Plasmodium*, *Entamoeba*, *Giardia*, *Leishmania*, *Toxoplasma*):
  - **Metronidazole**: For amoebiasis and giardiasis.
  - **Primaquine**: For *Plasmodium vivax* and *Plasmodium ovale* to prevent relapse.
  - **Pyrimethamine + Sulfadiazine**: For toxoplasmosis.
  - **Paromomycin**: For leishmaniasis and as a luminal agent for amoebiasis.

B. Anthelmintic Agents

- **Nematodes** (roundworms, e.g., *Ascaris*, *Hookworms*, *Pinworms*, *Strongyloides*):
  - **Albendazole**: Broad-spectrum treatment for many nematodes.
- **Trematodes** (flukes, e.g., *Schistosoma*, *Fasciola*):
  - **Praziquantel**: Effective against most trematodes.
- **Cestodes** (tapeworms, e.g., *Taenia*, *Echinococcus*):
  - **Praziquantel**: For most tapeworm infections.
  - **Albendazole**: For hydatid disease.


Thank
You