
Chapter 4. General Parasitology

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CHAPTER PREVIEW

- General Parasitology
- Life Cycle of Parasites
- Laboratory Diagnosis of Parasitic Diseases
- Treatment of Parasitic Diseases

Parasite is a living organism, which lives in or upon another organism (host) and derives nutrients directly from it, without giving any benefit to the host.

Medical Parasitology deals with the study of animal parasites, which infect and produce diseases in human beings. Parasites may be classified as—protozoans and helminths.

- **Protozoa:** They are unicellular eukaryotic cells that perform all the physiological functions
- **Helminths:** They are elongated flat or round worm-like parasites measuring few millimeters to as long as few meters. They are eukaryotic multicellular and bilaterally symmetrical.

Medically important protozoans and helminths are listed in **Table 4.1**.

LIFE CYCLE OF PARASITES

The life cycle of parasites depends upon three factors: host, mode of transmission, and infective form.

- **Host:** It is an organism, which harbors the parasite and provides the nourishment and shelter
- Hosts can be classified into a *definitive host* (where the parasite undergoes a sexual cycle) or an *intermediate host* (where the parasite undergoes an asexual cycle)

Table 4.1. Medically important protozoans and helminths.

<i>Medically important protozoans</i>
Amoebae

Medically important protozoans
<ul style="list-style-type: none"> • <i>Entamoeba histolytica</i> • Free-living amoebae: <i>Naegleria</i>, <i>Acanthamoeba</i>, <i>Balamuthia</i>
Flagellates
<ul style="list-style-type: none"> • Intestinal flagellate: <i>Giardia</i> • Genital flagellate: <i>Trichomonas</i> • Hemoflagellates: <i>Leishmania</i> and <i>Trypanosoma</i>
Apicomplexa
<ul style="list-style-type: none"> • Malaria parasites and <i>Babesia</i> • Opportunistic coccidian parasites: <i>Toxoplasma</i>, <i>Cryptosporidium</i>, <i>Cyclospora</i>, and <i>Cystoisospora</i>
Miscellaneous protozoa: <i>Balantidium coli</i>
Medically important helminths
Cestodes
<i>Diphyllobothrium</i> , <i>Taenia</i> , <i>Echinococcus</i> , and <i>Hymenolepis</i>
Trematodes or flukes
<i>Schistosoma</i> , <i>Fasciola</i> , <i>Clonorchis</i> , <i>Opisthorchis</i> , <i>Fasciolopsis</i> , and <i>Paragonimus</i>
Intestinal nematodes
<i>Trichuris</i> , <i>Enterobius</i> , Hookworm, <i>Strongyloides</i> , and <i>Ascaris</i>
Somatic nematodes
Filarial nematodes, <i>Dracunculus</i> and <i>Trichinella</i>

- Depending upon the number of hosts involved, the life cycle of the parasite may be direct or indirect
 - ◆ In the *direct life cycle*, the parasite requires only one host to complete its development
 - ◆ In the *indirect life cycle*, the parasite requires two/or three hosts (one definitive host and another one or two intermediate host/s) to complete its development.
- **Infective form:** It is the morphological form of the parasite which is transmitted to man
- **Mode of transmission:** Parasites may be transmitted by various modes such as ingestion, skin penetration, vector-borne, sexual, vertical, blood transfusion, and autoinfection.

Details of the life cycle of some of the important human parasites have been described in Chapter nos. 27-34.

LABORATORY DIAGNOSIS OF PARASITIC DISEASES

Laboratory diagnosis plays an important role in establishing the specific diagnosis of various parasitic infections. Following are the techniques used in the diagnosis of parasitic infections.

Examination of Feces

Stool examination is the most common diagnostic technique used for the diagnosis of intestinal parasitic infections.

Specimen Collection

Stool specimens should be collected in wide-mouthed, clean, leak-proof, screw-capped containers (Fig. 4.1).

Fig. 4.1. Sample container for stool.



- **Timing:** Specimen should be collected before starting anti-parasitic drugs and closer to the onset of symptoms
- **Frequency:** At least three stool specimens collected on alternate days (within 10 days)
- **When to examine:** Liquid stool specimens should be examined within 30 minutes, semisolid stools within 1hr, and formed stools up to 24 hours after collection
- **For monitoring response to therapy:** Repeat stool examination can be done 3 to 4 weeks after the therapy for intestinal protozoan infection, and 5–6 weeks for *Taenia* infection
- **Specimens other than stool:**
 - *Perianal swabs* (cellophane tape or NIH swab): Useful for detecting eggs of *Enterobius vermicularis* deposited on the surface of the perianal skin
 - *Duodenal contents:* It is very useful for the detection of small intestine parasites like *Giardia intestinalis* and larva of *Strongyloides stercoralis*.

Macroscopic Examination

Macroscopic examination of stool may provide a clue about various parasitic infections.

- **Muroid bloody stool:** Found in acute amoebic dysentery
- **Color:** Red-colored stool indicates gastrointestinal tract (GIT) bleeding
- **Frothy pale offensive stool** (containing fat) is usually found in giardiasis
- **Stool consistency:** In liquid stool, trophozoites are usually found; whereas in semi-formed stool both trophozoites and cysts are found and the cysts are mainly found in formed specimens.

Microscopic Examination

The microscopic examination includes direct wet mount examination and permanent staining methods.

Direct Wet Mount (saline and iodine mount)

Drops of saline and Lugol's iodine are placed on the left and right halves of the slide respectively (*Fig. 4.2*).

Fig. 4.2. Saline and iodine wet mount.



Source: Department of Microbiology, JIPMER, Puducherry (*with permission*).

- A small amount of feces is mixed with a stick to form a uniform smooth suspension
- A cover slip is placed on the mount and examined under a low power objective (10x) and then followed by a high power objective (40x) for the detection of protozoan cysts/trophozoites and ova of helminths
- **Normal constituents of stool specimen:** These include plant fiber, starch cells, muscle fibers, animal hair, pollen grains, yeast cells, bacteria, fat globules, air bubbles, etc.

Saline Mount

The saline mount is useful in the detection of trophozoites and cysts of protozoan parasites, and eggs and larvae of helminths. It has the following advantages over than iodine mount.

- The motility of trophozoites and larvae can be demonstrated
- Bile staining property can be appreciated—bile stained eggs appear golden brown and non-bile stained eggs appear colorless.

Note: Examples of non-bile stained eggs—*Enterobius*, hookworm, and *Hymenolepis nana* eggs.

Iodine Mount

- *Advantages:* Nuclear details of protozoan cysts, helminthic eggs, and larvae are better visualized, compared to saline mount
- *Disadvantages:* Iodine immobilizes and kills the parasites, hence motility of the trophozoites and helminthic larvae cannot be appreciated.

Concentration Techniques

If the parasite output is low in feces and direct examination may not be able to detect the parasites, then the stool specimens need to be concentrated.

Commonly used concentration techniques are:

- **Sedimentation techniques:** Example includes formalin-ether concentration technique
- **Flotation techniques:** Example includes saturated salt solution flotation technique.

Examination of Blood

Blood smear examination after staining with various Romanowsky stains such as Leishman's stain or Giemsa stain is useful in the diagnosis of infection caused by blood parasites like *Plasmodium*, *Trypanosoma*, *Leishmania*, *Wuchereria bancrofti*, *Brugia malayi*, etc.

Immunodiagnostic Methods

Immunodiagnostic methods involve the detection of parasite-specific antibodies in serum or the detection of circulating parasitic antigens in the serum.

- **Antibody detection tests:** Antibodies are detected in various parasitic infections; mainly from serum or from other specimens (like CSF in case of neurocysticercosis)
 - Antibodies can be detected by ELISA or immunochromatographic test (ICT)
 - Indications for antibody detection: Amoebic liver abscess, visceral leishmaniasis, toxoplasmosis, cysticercosis, hydatid disease, and lymphatic filariasis.
- **Antigen detection tests:** Indications for antigen detection in the diagnosis of parasitic diseases include—amoebiasis, malaria, and lymphatic filariasis.

Molecular Methods

Molecular methods most frequently used in diagnostic parasitology include—polymerase chain reaction (PCR) and real-time PCR.

TREATMENT OF PARASITIC DISEASES

Treatment of parasitic diseases primarily is based on chemotherapy and in some cases surgery.

- **Anti-parasitic drugs:** Various chemotherapeutic agents are used for the treatment and prophylaxis of parasitic infections
- **Surgical management:** It is useful for the management of parasitic diseases like cystic echinococcosis, neurocysticercosis, etc.

Details of treatment of some of the important human parasites have been described in Chapter nos. 27-34.

EXPECTED QUESTIONS

1. I. Write short notes on:

1. Medically important parasites.
2. Role of stool microscopy in the diagnosis of parasitic diseases.

2. II. Multiple Choice Questions (MCQs):

1. **Advantages of the saline mount are all, except:**

- a. Useful in the detection of trophozoites and cysts of protozoan parasites and eggs and larvae of helminths
- b. Nuclear details of cysts are better visualized
- c. The motility of trophozoites and larvae can be seen
- d. Bile staining property can be appreciated

2. **A stained peripheral blood smear is useful for the diagnosis of all of the following parasitic infections, except:**

- a. Malaria
- b. Filaria
- c. Hookworm disease
- d. Leishmania

3. **All are non-bile stained eggs, except:**

- a. *Enterobius*
- b. Hookworm
- c. *Ascaris*
- d. *Hymenolepis*

Answers

1. b	2. c	3. c
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