

Sheet n.

Doctor 22

فريق طوفان الاقصى



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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

This lecture is an introduction, so you'll find many things mentioned without content or explanation!

PARASITOLOGY (علم الطفيليات):

Medical Parasitology: It is the science which deals with the parasites that infect man.

Parasite: Is an organism, which lives on (ectoparasite which causes infestation) or within (endoparasite which causes infection) another organism (host) for survival.

Host: Is a living organism that harbours the parasite.

- Parasitic kingdom includes three phyla

- I- Protozoa (الكائنات الأولية). II- Helminths (الديدان). III- Arthropods (نواقل الأمراض).

• I- PROTOZOA:

- Is a phylum of the animal kingdom consisting of unicellular parasites (single cell organisms), divided into 4 classes according to the organ of locomotion (they are divided based on two things: locomotion or if there is sexual production):

- 1- Class sarcodina (also known as Rhizopoda): Parasites that move by means of pseudopodia (الأيادي الوهمية) example *Entamoeba histolytica* (which causes amebiasis الزحار الأميبي).

- 2-Class mastigophora (also known as Flagellate): Parasites that move by means of flagella (السطوط) as a part of their morphology, example *Giardia lamblia* (It causes Giardiasis, also called Beaver Fever in Canada which is an intestinal disease).

- 3- Class ciliates: parasites that move by means of cilia (الشعيرات), for example *Balantidium coli* (It causes a disease known as Balantidiasis).

The previously mentioned classes reproduce asexually.

- 4- Class Sporozoa: This class of parasites have both sexual and asexual reproductive organs; all these parasites are obligate intracellular so, one of its pathogenesis is cellular destruction, and they have no organ of locomotion (they move via gliding (انزلاق/تزحلق) since they don't have pseudopods nor cilia nor flagella), example *Plasmodium* parasites causing malaria (causative agent of malaria and they live in RBC's which reflects on their manifestation causing anemia), **cryptosporidium** & Cyclosporas.

• II- HELMINTHS:

- They are metazoa (Multicellular parasite) wormlike parasite, divided into 3 classes (mainly two: nematodes/ roundworms and platyhelminthes/ flatworms):

- 1- Class Nematoda (Roundworms):

Roundworms (الديدان الأسطوانية): If we take a cross section from them it'll look cylindrical.

- a- Intestinal nematodes, e.g., *Ascaris lumbricoides*.
- b- Tissue nematodes, e.g., *Wuchereria bancrofti*.

which cause a disease known as elephantiasis (patient's foot looks like an elephant's foot).

This class contains separate sexes male and female.

• **2- Class Cestoda (Tapeworms and cestodes means segmented so if we examine patient's stool, we'll find them segmented):**

• They are flattened and segmented worms e.g.: *Taenia saginata*, *Taenia Solium*, *Echinococcus Granulosus* (causes hydatid disease) and *Diphyllobothrium Latum*.
“don't worry we will discuss them in details later on ^^”.

• **3- Class Trematoda (Flukes):**

• They are flattened leaf- shaped worms e.g.: *Schistosoma heamatobium*.

It causes Schistosomiasis, but there are three members: *Schistosoma mansoni* and *Schistosoma Japonicum* cause Schistosomiasis in intestine, while *Schistosoma haematobium* causes Schistosomiasis in urinary bladder and this type (that affects urinary bladder only) is called bilharzia.

>> Class 2 and 3 known as Platyhelminthes (flatworm meaning that when we take a dorsi and ventrally cross section, they'll look flattened) and they don't have separate sexes, flatworms are also called Hermaphrodites. Which means that the same parasite contains male and female reproductive organs. But *Schistosoma* is an exception to this rule, and it has separate sexes.

• **III- ARTHROPODS** (just another name for vectors):

• These parasites having exoskeleton and jointed legs, divided into 2 classes:

- 1- Class Insecta: e.g. Mosquitoes, lice (القمل) and flea (البراغيث) .
- 2- Class Arachnida: e.g. Ticks (القراد) and mites (العث).

Also, we can classify it into:

- Mechanical Arthropods: it only transfers the parasite from infected to other non-infected (susceptible).
- Biological Arthropods: it becomes as a part of the life cycle of transmitted parasite.

Biological vectors, such as mosquitoes and ticks may carry pathogens that can multiply within their bodies and be delivered to new hosts, usually by biting. Mechanical vectors, such as flies, can pick up infectious agents on the outside of their bodies and transmit them through physical contact. (this paragraph is from google just for further understanding)

TYPES OF PARASITES:

- 1- Ectoparasite: A parasite that lives on the surface of the host. It causes infestation.
Ex: Lice
- 2- Endoparasite: A parasite that lives inside the body of its host. It causes infection.
Ex: Entamoeba Histolytica
- 3- Obligatory parasite: A parasite that is completely dependent upon a host for its survival.
- 4- Facultative parasite: A parasite that is capable of living both freely and as a parasite. Obligatory parasite & Facultative Parasite both are related to survival of the parasite *important*.
- 5- Permanent parasite: A parasite that spends its life cycle on or in the body of its host. It can't complete its life cycle outside the host (note that here we are talking about life cycle too not just about survival).
- 6- Temporary or Intermittent parasite: A parasite that visits its host only for a short period of time for its meal, it can complete its life cycle inside or outside the host (free living stages).
- 7- Opportunistic parasite: A parasite that causes disease only in immunodeficient patients (AIDS, cancer patients), while in immunocompetent individuals, the parasite may exist in a latent form producing no or mild symptoms.
- 8- Coprozoic or spurious parasite: An organism that passes through the human (it's common in animals too) intestinal canal without causing any symptom or disease and is detected in the stool after ingestion.

TYPES OF HOSTS:

The most important are definitive host and intermediate host

- 1- Definitive host (D.H): It is the host which harbours the mature adult stage of the parasite or in which sexual reproduction of the parasite takes place. Ex: man in case of Taenia (notice that the occurrence of only one of the above is enough to call the patient a definitive host)
- 2- Reservoir host (R.H): The host which harbours the parasite and considered the source of human infection (potential source for the infection and we may also classify it D.H or I.H depending on the case). Ex: Dog in case of kala – azar الحمى السوداء visceral leishmaniasis), it means black fever, which is caused by the parasite (Leishmaniadonovani). It acts also as a source of infection to man and maintains the parasite in nature.
- 3- Intermediate host (I.H): It is the host which harbours larval stage (immature or non-sexually reproducing forms of the parasites).

Ex:

-Snail in case of Bilharzia.

- القوقع

4- **Accidental host:** The host which harbours the parasite which is not normally found. Ex: The Toxo cara (الديدان الخيطية) dog nematode) in man.

Normally it doesn't affect Humans but accidentally it might affect humans.

>> To find a parasite in others host rather than the normal one.

THE RELATIONSHIP BETWEEN THE ORGANISM AND ITS HOST OCCURS IN THE FOLLOWING FORMS:

- 1- **Commensalism:** It is a relationship between two living organisms where one gets benefit (commensal), while the other (host) is not harmed. Ex: Entamoeba coli
- 2- **Parasitism (التطفل):** It is a relationship between two living organisms where one gets benefit (parasite), while the other (host) is harmed.
- 3- **Mutualism (التبادل):** It is a beneficial relationship between two living organisms where both drive a benefit and can successfully live apart.
- 4- **Symbiosis:** the relationship between two living organisms. They just live and interact with each other. So, it contains the above three definitions (Commensalism, Parasitism & Mutualism).

*The doctor mentioned that the definition written in the slide related to symbiosis "should be deleted" *

MODES OF TRANSMISSION OF PARASITIC INFECTION:

- 1- **Direct contact through the skin** (will be explained later).
- 2- **Penetration of the skin:** For example: schistosomes can cause Schistosomiasis when people swim in contaminated water, it can penetrate the skin and cause the infection.
- 3- **Ingestion of contaminated food or drinking water containing the infective stage of the parasite.** The most famous one in intestinal parasite is Fecal-Oral transmission.
- 4- **Inhalation of dust carrying the infective stage of parasite.**
- 5- **Congenital: from mother to fetus (transplacental)** as Torch infection, which is a cluster of symptoms caused by congenital infection with toxoplasmosis. Or it may be transmammary through lactation (mother's milk) like Ascaris.
- 6- **Sexual contact:** For example, Trichomonas vaginalis which causes Trichomoniasis.
- 7- **Autoinfection:** is such a way that the complete life cycle of the parasite happens in a single organism without the involvement of another host. Either External as Pinworm (Enterobius vermicularis which is a common infection worldwide) they females migrate through the anus and go to the perineum (anal cleft) and lay their eggs there (it's considered outside the body), since it is itchy the children will scratch it and put their hands to their mouth so the parasite reenters the

body again or **Internal** (applied on one parasite only) as Human Threadworm (*strongyloides stercoralis*), doesn't require to be transported outside the host to reinitiate the infection.

- 8- **Vectors: through bite or feces of infected vector or by swallowing the vector.** For example, Sand Fly can transfer *Leishmania Tropica/Major* which causes a disease called Cutaneous Leishmaniasis (in Jordan, we find it in Aqaba but we don't have visceral leishmaniasis that was mentioned before in R.H).
- 9- **Blood transfusion or through contaminated syringes: mainly protozoa. Ex: plasmodium which causes Malaria, Trypanosoma, Toxoplasma and Leishmania.**
- 10- **Organ transplantation.**

Any thing with star * it is important.

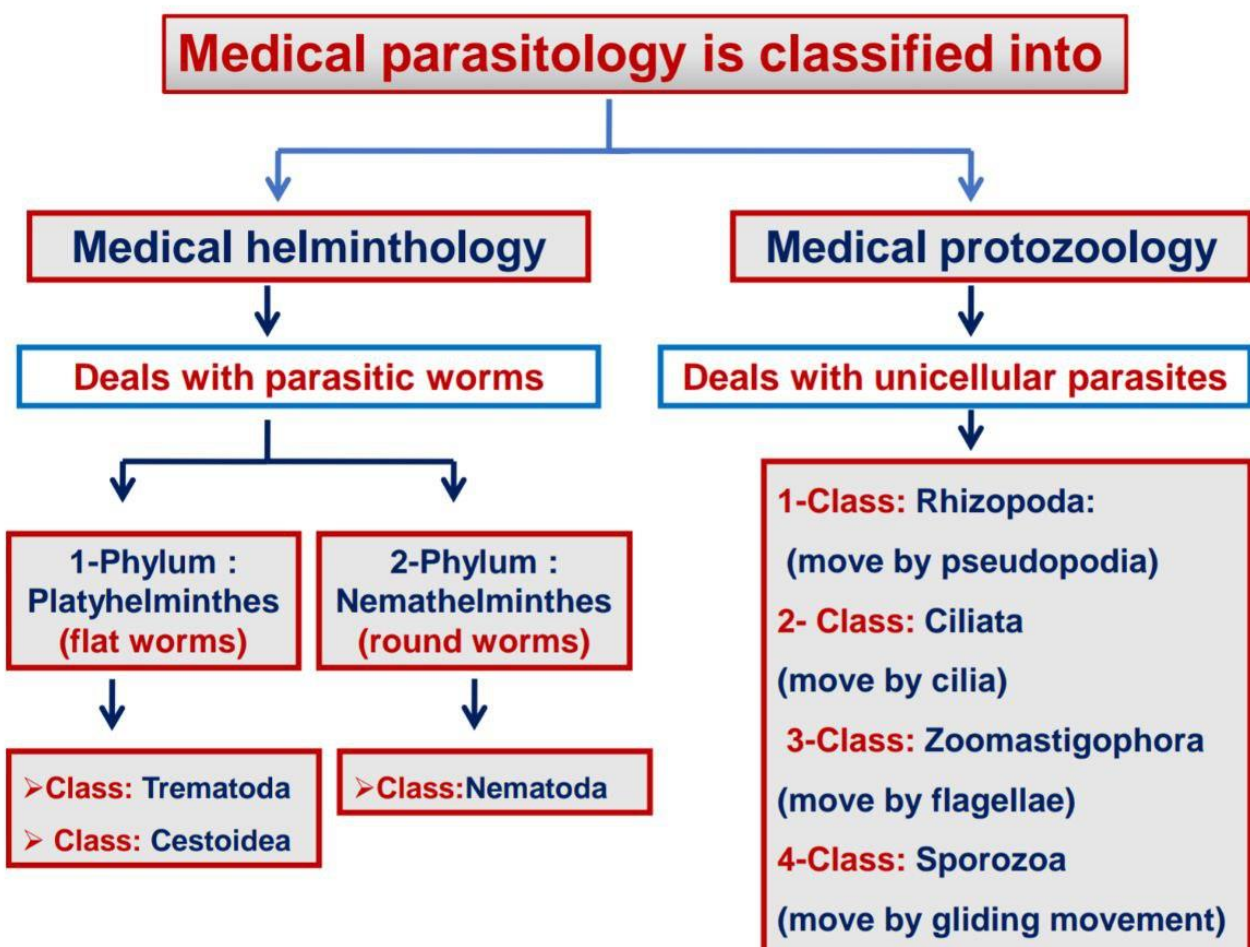
TERMS USED IN PARASITOLOGY

- **Habitat:** The natural site where the parasite lives.
- **Carrier:** A host in a state of equilibrium with parasite without or with minimal symptoms of the disease, but he is infective to others.

* We must differ between carrier and latency state (we mention it in mycology Lec)

Latency state: no symptoms and they are not infective to others.

- **Zoonosis:** is a term applied to zoonotic diseases which are diseases transmitted from animals to human either directly or indirectly via intermediate host (vector) e.g. viruses transmitted by arthropod vectors (arbovirus) causing a disease known as Viral Hemorrhagic Fever. الحمى النزفية.
- **Infective stage (I.S):** The stage by which the infection takes place. (The developmental stage that the parasites enter the body).
- **Diagnostic stage (D.S):** The stage by which we can diagnose the parasitic infection (disease). (The stage that the parasites leave the body. These two terms are very important).



PATHOGENESIS OF PARASITIC INFECTION

لقدام بس نذكر المرض
هنذكر معاه ايش يطبق
من هنذول

Occurs through the following:-

1) **Mechanical:** The parasite may obstruct normal passage like intestine or bile tract as large parasites can cause obstruction in colon.

For helminths, the most important pathological manifestation is the mechanical obstruction

2) **Traumatic:** -

- ✓ External due to invasion of the skin.
- ✓ Internal by attachment to intestinal mucosa by buccal capsule producing ulcers.

As in Amebiasis (*Entamoeba histolytica*) in which the Parasite lives only in the colon tube which we called Luminal Amebiasis, in other stage there might be invasion for mucosa & submucosa. So Luminal Amebiasis causes diarrhea but when invasion of the wall occurs here will be dysentery زحار (Blood +Mucus with diarrhea).

3) **Toxin production:** Circulation of parasitic products (toxins and waste products).

4) **Tissue damage and necrosis:** Due to enzymes secreted by parasites.

5) **Cellular destruction:** As Plasmodium (lives intracellularly) in RBCs or RES damage.

6) **Immune stimulation:** Parasitic antigens produce humoral /or cellular immune response → cellular proliferation and infiltration → formation of fibrous encapsulation around parasites (ex: hepatic granuloma in *Schistosoma mansonia*).

In Helminths a lot of diseases result from immune reaction to the present of adult stage, but not all of them like: *Schistosoma* or Schistosomiasis the main pathology is immune reaction to the eggs of *Schistosoma* not adult stage.

7) **Allergic reaction due to insect bites or parasitic toxins.**

Remember:

Lymphocyte → viruses

Neutrophils → bacteria

Eosinophil as well as IgE mediated → Parasites.

The pathogenesis of the parasite depends on the number, size and morphology of the parasite, its activity (movement and migration), site (habitat), specific toxin and host reaction. (The Parasite itself, Immune Response & the environments factors).

DIAGNOSIS OF PARASITIC INFECTION:

I) **Clinical diagnosis:** - Depends on the characteristic signs and symptoms related to the parasitic infection.

II) **Laboratory diagnosis:** -

Direct methods (to detect the diagnostic stage): - Microscopical examination of the tested samples (ex: 1- stool, 2- urine (genitourinary system), 3- blood ,4- tissue biopsy, 5- sputum & 6-aspirates (collecting fluid from affected site)).

1-STOOL EXAMINATION

o Mainly for intestinal infection.

o Must collected in clean, dry, tight fitting lid containers.

o Macroscopic examination: for consistency, composition, color, and presence of adult parasites such as *Enterobius vermicularis*, *Taenia* segments (Proglottids) & *Ascaris* worm.

>> The idea is sometimes the person might go to bathroom and feel that there is something with the feces that he can see it with his eyes.

o Microscopic examinations:

❖ Direct saline smear or iodine smear: when helminthic eggs & protozoa cyst are in large numbers.

❖ Concentration techniques: if the parasites are scanty.

❖ Permanent stained smear: we fixed the slide (formalin fixed) for correct identification of most protozoa. (You can back to them at any time, Good for documentation)

>> The idea here that you take 1-2 grams from feces then put it on slide with saline. Sometimes the number of parasites is little, we do concentration to increase our chance of seeing parasites, there eggs, cyst.....

2- URINE EXAMINATION

-because there is some affect genitourinary system.

✓ The urine sample is examined macro& microscopically.

✓ Certain parasites can be detected in urine as *Schistosoma haematobium* eggs, *Trichomonas vaginalis* trophozoites (sexual transmitted disease) (it presents in the vagina and can be detected in the urethra >> ectopic infection within the pelvis) & eggs of *Enterobius vermicularis* (commonly known as the pinworm) (here there is an ectopic infection within the pelvis, these eggs should present in the intestine not in the urine, because it causes an intestinal infection.

Ectopic infection within the pelvis: generally, refers to the occurrence of an infection in a location outside its normal or expected site, specifically within the pelvic region.

3- BLOOD EXAMINATION

Blood droplet= thick → اذا مسحتها بتصير Thin

✓ Thin blood film: to demonstrate the morphological features of the parasites.

Here I can know what Parasite is this.

✓ Thick blood film: droplet from the blood to obtain large amount of it which increase possibility of detecting light infection. Parasites detected in the blood are Malaria (plasmodium), Leishmania, Filaria (affect mainly lymphatic system) & Trypanosomes. (Only for detecting the existing of the parasite or not)

Trypanosomiasis: one of the blood flagellate diseases, clinically have 2 types:

1- American Trypanosomiasis (Chagas Disease) **بعمل مشاكل بالقلب**

2- African Trypanosomiasis (Sleeping Sickness) CNS

راح نحكي عنهم لاحقا يبدو (:)

4- TISSUE BIOPSY

Tissue biopsy specimens are recommended for diagnosis a number of parasitic infections.

For example:

"In the muscle"

- Muscle biopsy in *Trichinella spiralis*. (The only helminth that lives intracellularly)
- Rectal biopsy in detecting *Schistosoma ova*. not *Schistosoma haematobium* that affect urinary bladder.

5- SPUTUM EXAMINATION

بلغم

o Sputum is examined to detect parasites that:

- ✓ living in the lung. Ex: *Paragonimus westermani*.
- ✓ migrating through the lung. (like some helminths in order to complete their life cycle they must be transported through the pulmonary system.)

هسا بخصوص اختراق الرئة في تفسيرين الأول: انه عبارة عن جزء من دورة حياتها الثاني: انه اذا كان النضج ناعها يحتاج شهر فاذا ضلت بالقولون مع حركة الأمعاء راح تطلع, فبتروح للرئة بعدين برجع يبلعها المريض بدون ما يحس عخالو وبترجع مرة ثانية عالقولون وبتكون صارت ناضجة

So it do this (migration through the lung) to avoid flushing away

- ✓ parasites which result from rupture of cysts in the lung.

o Parasites detected in the sputum are:

- ✓ Eggs of *Paragonimus westermani*.
- ✓ Trophozoites of *Entamoeba histolytica* which causes Amebiasis, and it may cause extraintestinal amebiasis, they may migrate to several sites (skin, brain, liver, lung)
- ✓ Parts of ruptured hydatid cyst (very important thing in surgery) presents mainly in the lung and the liver. Its causative agent is a parasite known as *Echinococcus granulosus*
- ✓ Migrating larvae of *Ascaris*, *Ancylostoma* (hookworm) & *Strongyloides*. Those parasites migrate through the lung as part of their life cycle.

6- ASPIRATES EXAMINATION

<https://www.youtube.com/watch?v=EYd7OnCt7u>

- ❖ Cerebrospinal fluid may be used for detection of certain parasites of CNS such as - *Trypanosoma spp* like (*Trypanosoma rhodensiense/gambiense*) it causes African trypanosomiasis also known as sleeping sickness.

The abbreviation "spp" is used in scientific nomenclature to indicate multiple species within a genus when the specific species are not listed. So, when referring to *Trypanosoma* spp, it means multiple species within the genus *Trypanosoma*.

- **Naegleria**

❖ **Duodenal aspirates (Enterotest): for examination of duodenal contents.**
(with some helminths that affect GI system and live in the duodenum like *Ancylostoma duodenale*)

- **Parasites which can be present as *Giardia lamblia*, *Strongyloides* larva & *Cryptosporidium parvum*.**

V2: slide 2

cryptosporidium

instead of

cryptoporticus