Medical Aspects of parasitology

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RMU is thriving to upgrade the Integrated Clinical Oriented Modular Curriculum and Teaching. There are many deficiencies in this system which RMU has learned with five year experience of real ground experience. We have designed the teaching (lecture) model of integration, covering all components of vertical and horizontal and clinical integration along with continuous step ladder pattern of research, professionalism and ethic. This teaching strategy is in alignment with assessment principles of integrated modular curriculum.



Learning Outcomes

At the end of this lecture, students of 3rd year MBBS should be able to

- Classify different types of parasites
- Describe clinical features, investigations and treatment of medically important parasites



SPIRAL INTEGRATION

Parasite

- An organism baring food and shelter temporarily or permanently and living in or on another organism.
- The study of parasites is called Parasitology.
- The study dealing with parasites of man and their medical importance is called Clinical Parasitology



Classification of Parasites

CORE SUBJECT





Medically important Parasites

CORE SUBJECT Entamoeba Histolytica

- Disease: Amoebiasis
- Mode of locomotion: Pseudopodia (false feet)
- Geo. Dis.: cosmopolitan, but more common in tropical and subtropical countries and countries with poor sanitation
- Habitat: in the lumen of the large intestine (it is pathogenic because it can invade the wall of the intestine)
- Reservoir: major: humans

minor: dogs, pigs, monkeys

Mode of transmission: Feco-oral route





Amoebiasis

• 2 morphologic forms:

Cyst

Infective stage: in polluted water and infected food

Trophozoite

Pathogenic stage: give pathology as a result of infection



Clinical Picture

- Dysentery: blood + mucous diarrhea (as a result of flask shape ulcer wall invasion)
- Severe abdominal pain
- Tenesmus: a sense of incomplete evacuation
- Complications
 - A. Intestinal: peritonitis, appendicitis, Hemorrhage
 - B. Extra intestinal: Hepatic(Hepatitis, Liver abscess), lung, skin, and brain



HORIZONTAL INTEGRATION Treatment & Prevention

Antimicrobial therapy	Amoebic liver abscess	Intestinal amoebiasis 750–800mg three times daily for 5–10 days	
Metronidazole	750–800mg three times daily for 10 days		
Tinidazole	2 g daily for 5 days	2 g daily for 3 days	
Paromomycin	-	25–35mg/kg per day, divided into three doses, for 7 days	
Diloxanide furoate	-	500mg three times a day for 10 days	

Source: Farthing, 2005^[53]

Prevention

- Proper hand hygiene
- Proper purification of water
- Avoid using night soil (human feces) for soil fertilization



CORE SUBJECT

Malaria

- Worldwide malaria is the most common infectious disease and leading cause of death.
- Geo. Dis.: Previously extremely widespread, malaria is now mainly confined to Africa, Asia, and Latin America
- Causative agent: Malaria is caused by protozoan parasites of the genus *Plasmodium*.
- Transmission: Female Anopheles Mosquito.
- 4 different species of Plasmodium





Sexual Reproduction in Mosquito Host



VERTICAL INTEGRATION Clinical Picture

Merozoites invade the RBCs, infecting them.

- A large number of infected RBCs rupture roughly at the same time, causing massive release of toxic substance and leading to a sudden rise in body temp. (Fever)
- P. malriae, P. vivax, and P. ovale causes milder disease, as they invade either young or RBCs but not both. This is in contrast to P. falciparum, which invades cells of all ages hence making it dangerous of all the species.
- Plasmodium falciparum is characterized by persistent high fever and orthostatic hypotension. Infection can lead to capillary obstruction and death if treatment is not introduced. Massive hemolysis can cause significant hemoglobinuria and hence "Black water Fever"



HORIZONTAL INTEGRATION Diagnosis & Treatment

- Thick and thin film of blood (presence of parasite and species type and no. respectively).
- Trophozoites are ring-shaped. Gametocytes of falciparum are crescent-shaped while the rest are spherical.
- If more than 5% of RBCs are parasitized then most likely plasmodium falciparum malaria
- PCR based test for plasmodium nucleic acid or ELISA for protein specie for P falciparum species.

Species	Drugs	Route of administration
Chloroquine sensitive P. falciparum and P.malariae	Chloroquine	Oral
Chloroquine sensitive P. vivax and P. ovale	Chloroquine plus primaquine	Oral (donot use primaquine if G6PD deficient)
Chloroquine resistant P. falciparum with uncomplicated infection	Coartem (artemether and lumefantrine)or Malarone(Atovaquone and proguinal)	Oral
Chloroquine resistant P. falciparum with severe complicated disease	artesunate or quinidine	Intravenous



Species	Falciparum	Vivax	Malariae	Oval
Ring Stage	9	t a	0	2
Trophozoite	0		R.	0
Schizont	3	3	3	
Gametocyte	1			



CORE SUBJECT Toxoplasma Gondii

- Disease is called "Toxoplasmosis"
- Transmission:
- 1. eating row, undercooked meat of sheep and cow contaminated with infected cat feces
- 2. swallowing food and water contaminated with infected cat feces
- 3. No person-to-person transmission except vertical transmission
- Clinical symptom:
 - Immunocompetent individuals remained asymptomatic
 - Immunocompromised individuals have severe infections who may also suffer recrudescence (relapse) of the infection.
 - Congenital infections can result in abortion, & stillbirth,
 - Neonatal infection with encephalitis, chorioretinitis, and hepatosplenomegaly. Fever, jaundice, and intracranial calcifications are seen. They are the major cause of blindness in newborns.



VERTICAL INTEGRATION Diagnosis & Treatment

Diagnosis

- Immunoflourescence assay for IgM antibodies or high IgG titers for congenital infection
- Microscopic examination of Giemsa stained preparation shows crescent-shaped trophozoites during acute infection

Treatment

 Congenital toxoplasmosis whether symptomatic or asymptomatic should be treated with a combination of sulfadiazine and pyrimethamine (Sulfamethoxazole and trimethoprim)





CORE SUBJECT Ascaris Lumbricoides

- Ascaris lumbricoides is the largest Nematode (roundworm) parasitizing the human intestine
- 1/3 the world population is infected with this worm
- Geo.dis.: worldwide, common among people with low standard of living and children
- Morphology: Adult form: Make & Female worms in small intestine, Egg form: infective stage.
- Each female produces 200,000 eggs per day
- Adult worms can live 1 to 2 years.



CORE SUBJECT

Life Cycle

- 2 phases: lung and intestinal
- Egg ingested (1-4)
- hatches in duodenum; larvae penetrate the intestine wall, enter blood vessels, and embolize through the liver to the lungs. (5-6)
- They then migrate into airspaces, up the trachea, and are swallowed, taking up permanent adult residence in the small intestine (7)
- 2 months from egg to mature adult



VERTICAL INTEGRATION Clinical Symptoms & Treatment

Clinical Picture related to the number of worms;

- small numbers are asymptomatic
- Iarge numbers of adults in the intestine:
 - Lung phase- Ascaris pneumonitis. In the lungs, it causes hemorrhage, inflammation, and bacterial infection. It also causes allergies in areas with seasonal transmission. Typically occurs at 6-14 days after initial exposure.
 - Intestinal phase- malnourishment, intestinal blockage, jaundice due to bile duct blockage. *A.lumbricoides* will move around in the body in response to chemotherapy or fever. Typically occurs at 6 to 8 weeks after initial exposure.

Diagnosis

Stool examination (oval eggs with irregular surfaces, occasionally adult worms can be seen in stool)

Treatment

Albendazole , mebendazole and ivermectin are effective







CORE SUBJECT Ancylosctoma Duodenale

- The Hookworms
- Worldwide especially in tropical areas

Features: Humans are infected with filariform larvae. Adult worms attach to the intestinal wall with either cutting plates (nectar) or teeth (Ancylostoma).

Mode of transmission: Penetration of skin while walking barefoot on moist soil

Clinical Features: Pallor, fatigue, Ground Itch, pruritic papules or vesicles at site entry to the skin, migrate under the skin causing cutaneous larva migrans, Pneumonia with eosinophilia

Diagnosis

- Stool examination
- Stool for occult blood
- CBC shows Eosinophilia

Treatment

Albendazole, mebendazole or pyrantel pamoate





VERTICAL INTEGRATION Entrobious Vermicularis

The Pinworms

 Worldwide infection commonly affects children younger than 12 years. Only humans are infected, no vector or animal reservoir.

Mode of Transmission: Feco-oral route

Clinical features: Perianal pruritis, and scratching lead to secondary infection.

Diagnosis:

- Scotch tape technique for microscopic examination
- Stool examination for small whitish adult worms in stool and in the diaper

Treatment: Albendazole, mebendazole, or pyrantel pamoate. Retreatment after 2 weeks.







Tenia Solium

 Cestodes or Tapeworms are ribbon-shaped multi-segmented flatworms that dwell as adults entirely in the human small intestine.

CORE SUBJECT

- Adult tapeworms can grow up to 25 meters but are usually closer to 5 meters in length
- The larval forms lodge in the skin, liver, muscles, the central nervous system, or any of various other organs
- Transmission: acquired in humans through the ingestion of raw or poorly cooked meat of infected pork. These pigs have been infected via the ingestion of human feces containing the eggs of the parasite.

Morphology:

An adult is divided into three parts,

- 1- Head: round and small. It has four suction disks
- 2- neck: A small, slender neck, about an inch long
- 3- number of segments.
- Egg present in feces





VERTICAL INTEGRATION Clinical Presentation & Management

- **Clinical Features**
- Asymptomatic
- Anorexia
- Diarrhea
- Cysticercosis in the brain causes headaches, vomiting, and seizures
- •Cysticercosis in eyes causes uveitis or retinitis, larva seen floating in vitreous
- Subcutaneous nodules/cysts in muscles







HORIZONTAL INTEGRATION

Diagnosis

- Stool examination: gravid proglottids with5-10 uterine branches in stool. Eggs are found less than proglottids
- Cyst demonstrated in tissue by surgical removal or CT scan
- ELISA detects antibodies to T. solium antigen

Treatment

- Praziquantel for intestinal worms
- Cysticercosis is either responsive to praziquantel or albendazole but surgical excision may be necessary



Trematodes

 Disease of the venous system, acquired by people when they come in contact with contaminated water

CORE SUBJECT

- Adult Schistosomes take up residence in various abdominal veins, depending on the species; they are, therefore called (Blood Flukes)
- Very common among children
- Geo. Dis.: developing countries, affects up to 200 million people
- Transmission: Direct skin penetration. Fresh water becomes contaminated by Schistosoma eggs when infected people urinate or defecate in the water. The eggs hatch and the parasites grow and develop inside snails.

2 types of Schistosomiasis:

- Intestinal Schistosomiasis
- Urinary tract Schistosomiasis





VERTICAL INTEGRATION

Clinical Presentation & Management

Pathology:

- host's inflammatory response to eggs deposited at the primary site.
- The eggs also secret proteolytic enzymes that further damage the tissue.
- the organism eggs can induce fibrosis and granulomas,

Clinical picture:

- Intestinal Schistosoma: GI bleeding, diarrhea, and liver damage.
- Urinary tract Schistosoma: hematuria

Disease: Bilharzia/Schistosomiasis

Diagnosis

- Stool examination shows ova in feces with lateral spine in S.mansoni, rudimentary spine for S. japonicum and terminal big spine for S haematobium
- CBC shows moderate eosinophilia

Treatment

Praziquantel is the treatment of choice for all species







