Introduction

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1.1 Definition of Parasitosis

Parasitosis or zoonosis is a term used to describe a disease in animals that may be accidentally transmitted to humans.

1.2 Classification of Parasites

Table 1.1 shows the classification of parasites.

1.3 Modes of Transmission

Humans acquire parasitic diseases by ingesting infested raw or undercooked foods, or by drinking contaminated water or fluids, or by skin bites and cutaneous penetration (Table 1.1).

1.4 Clinical Aspects

The symptomatology of parasitic diseases depends on the site of infection or organ involvement; the symptoms are often nonspecific.

For parasitic diseases that affect the central nervous system the clinical manifestations are often nonspecific and depend on the type and location of the lesions; however, the frequently encountered symptoms are fever, headache, seizure, and neurologic deficit.

For parasitic diseases of the lungs the chief complaints are frequently fever, coughing, chest pain, and hemoptysis. Zoonoses that are associated with pulmonary abnormalities on a chest radiograph and blood eosinophilia include: toxocariasis, ascariasis, strongyloidiasis, schistosomiasis, filariasis, ankylostomiasis, and paragonimiasis, the so-called Loeffler's syndrome, or eosinophilic pneumonia.

For parasitic diseases of the liver, spleen, and biliary tree, the frequently encountered signs are hepatosplenomegaly, cholangitis, jaundice, and abnormal liver function tests. Parasitic diseases that are associated with fever and hepatosplenomegaly with or without lymph node enlargement include visceral leishmaniasis, acquired disseminated toxoplasmosis, malaria, toxocariasis, schistosomiasis (Katayama syndrome), and trypanosomiasis.

Gastrointestinal tract involvement is characterized by abdominal pain, diarrhea, weight loss, and anemia. Parasitic diseases associated with diarrhea include protozoan diseases without evidence of blood hypereosinophilia such as amebiasis, giardiasis, *Cryptosporidium* and *Microsporidium* species in immunocompromised patients, and helminthic diseases such as ascariasis, enterobiasis, taeniasis, hookworms, strongyloidiasis, and schistosomiasis with evidence of blood hypereosinophilia (Bourée and Bisaro 2007).

Parasitic diseases associated with peripheral blood eosinophilia include most of the helminthic infections such as schistosomiasis, strongyloidiasis, toxocariasis, trichinosis, filariasis, echinococcosis, cysticercosis, dicrocoeliasis, fascioliasis, gnathostomiasis, *A. suum,* pentastomiasis, ankylostomiasis, anisakiasis, capillariasis, dracunculiasis, loiasis, taeniasis, trichuriasis, and onchocerciasis. The eosinophils act as parasite killers. Parasitic diseases associated with anemia include: malaria, visceral leishmaniasis, giardiasis, hookworms (*Ancylostoma duodenale* and *Necator americanus*), trichuriasis, diphyllobothriasis, babesiosis, and balantidiasis.

Table 1.1 Classification of parasites, modes of transmission, and treatment

Species	Modes of transmission					Treatment
	Meat	Fish	Water	Vegetables and soil	Skin	
A. PROTOZOA (unicellular organisms)						
Common						
Plasmodium (P. malariae, P. vivax, P. ovale, P. falciparum)					+	Quinine
Entamoeba histolytica			+			MNZ
Toxoplasma gondii	+		+			Pyrimethamine Sulfamonomethoxine
Trypanosoma cruzi					+	Nifurtimox Benznidazole
Leishmania (L. donovani, L. tropica, L. infantum)					+	Miltefosine Amphotericin B
Giardia lamblia			+			MNZ, nitazoxanide
Cryptosporidium parvum			+			Nitazoxanide
Rare						
Babesia microti	+					Atovaquone Azithromycin
Balantidium coli	+		+			Tinidazole/ Metronidazole Pimaricin/oxyteracine
B. METAZOA (multicellular organisms)						
HELMINTHS (WORMS)						
NEMATODES (ROUND WORMS)						
Common						
Ascaris lumbricoides			+			PP, ABZ, levamizole
Toxocara (T. cati, T. canis)				+		ABZ, DEC
Strongyloides stercoralis					+	TCBZ, IVM
Rare						
Ascaris suum	+					ABZ
Gnathostoma spinigerum		+				ABZ, TCBZ
Wuchereria bancrofti					+	IVM
Enterobius vermicularis			+	+		ABZ, PP
Ancylostoma duodenale					+	PP, TCBZ, MBZ
Trichuris trichiura			+	+		ABZ, MBZ

Table 1.1 *(continued)* Classification of parasites, modes of transmission, and treatment

Species	Modes of transmission					Treatment
	Meat	Fish	Water	Vegetables and soil	Skin	
Anisakis marina		+				Symptomatic treatment, TCBZ
Capillaria (C. philippinensis, C. hepatica)		+				ABZ
Necator americanus					+	PP, ABZ
Angiostrongylus (A. costaricensis, A. cantonensis)		+		+		Symptomatic treatment TCBZ, PP, ABZ
Dirofilaria (D. immitis, D. repens)					+	DEC
Bayliascaris procyonis			+			ABZ
Onchocerca volvulus					+	IVM, DEC
Loa loa					+	DEC
Dracunculus medinensis				+		MNZ, TCBZ
Trichinella spiralis	+					TCBZ, DEC, MBZ
Dioctophyma renale		+	+			Conservative treatment. Surgery
CESTODES (TAPE WORMS)						PZQ
Common						
Taenia (T. solium, T. saginata, T. multiceps)	+		+			ABZ, PZQ
Echinococcus (E. granulosus, E. multilocularis, E. vogeli, E. oligarthrus)			+	+		ABZ, PZQ
Rare						
Hymenolepis nana				+		Niclosamide, PZQ
Spirometra (S. mansoni, S. erinacei)		+	+			PZQ
Diphyllobothrium latum		+				Niclosamide, PZQ
TREMATODES (FLUKES)						
Common						
Schistosoma (S. mansoni, S. hematobium, S. japonicum, S. mekongi)					+	PZQ
Clonorchis sinensis		+				PZQ
Opisthorchis viverrini		+				PZQ
Fasciola hepatica				+		TCBZ, bithionol
Rare						
Dicrocoelium dendriticum	+					PZQ, mirazid
Paragonimus westermani	+	+				PZQ, bithionol
Heterophyes heterophyes		+		+	+	PZQ
Echinostoma (E. ilocanum, E. lindoense)		+		+	+	Niclosamide, PZQ

Table 1.1 *(continued)* Classification of parasites, modes of transmission, and treatment

Species	Modes of transmission					Treatment
	Meat	Fish	Water	Vegetables and soil	Skin	
Fasciolopsis buski		+		+	+	Niclosamide, PZQ
Metagonimus yokogawai		+		+	+	PZQ
ARTHROPODS						
Armillifer armillatus	+					IVM
Linguatula serrata	+					PZQ
Fannia canicularis	+	+		+		Disodium octaborate tetrahydrate

MNZ metronidazole, *TBZ* thiabendazole, *IVM* ivermectin, *PZQ* praziquantel, *PP* pyrantel pamoate, *TCBZ* triclabendazole, *ABZ* albendazole, *DEC* diethylcarbamazine, *MBZ* mebendazole

Table 1.2 Parasites with radiologically visible calcifications

Site of infection	Zoonosis	Imaging appearance of calcifications
Brain	Cysticercosis	Oval with lucent center
	Toxoplasmosis	Round
	Echinococcosis	Egg-shell, punctate
	Paragonimiasis	Round
	Sparganosis	Small punctate
Muscle	Cysticercosis	Oval with lucent center
	Pentastomiasis	Comma shape
	Paragonimiasis	Round
Urinary system	Schistosomiasis	Linear
	Echinococcosis	Egg-shell, punctate
Subcutaneous tissues	Dracunculiasis	Irregular coiled
	Loiasis	Thread-like coil
	Onchocerciasis	Filamentous
Peritoneum	Pentastomiasis	Comma shape
Liver	Echinococcosis (unilocular)	Egg-shell
	Echinococcosis (alveolar)	Punctate, cotton ball
	Schistosomiasis (*S. japonicum*)	Linear
	Pentastomiasis	Comma shape
	Paragonimiasis	Round
Lungs	Paragonimiasis	Round
	Cysticercosis	Oval with lucent center
	Pentastomiasis	Comma shape
Colon	Schistosomiasis	Pericolonic conglomerate
Spleen	Echinococcosis	Egg-shell, punctate
	Pentastomiasis	Comma shape

Parasitic diseases associated with cutaneous or subcutaneous lesions or nodules include: gnathostomiasis (creeping eruption), schistosomiasis (swimmer's itch or cercarial dermatitis), onchocerciasis (sowda), cutaneous leishmaniasis (Oriental sore), trypanosomiasis (trypanosomal chancre), hookworms (cutaneous larva migrans), sparganosis, dracunculiasis, loiasis (Calabar swellings), dirofilariasis (*D. repens*), strongyloidiasis, cysticercosis and dioctophymiasis (subcutaneous), cutaneous myiasis, cutaneous amebiasis, and epizoonoses caused by ectoparasites such as scabies and lice.

Parasitoses associated with radiologically demonstrable calcifications are listed in Table 1.2 (Thomas 1986).

1.5 Diagnosis

A high index of clinical suspicion is essential, as diagnosis of parasitic infection requires special sampling techniques and laboratory procedures. Definitive diagnosis is usually achieved by detecting the parasite in the patient's tissues or body fluids by histological examination or culture, or by polymerase chain reaction amplification of the parasite-specific antigen sequence. Antibody detection using serological techniques is also possible in a few parasitic infections. Certain lesions have characteristic radiological appearances, hence the value of imaging, particularly in the cerebral syndromes (Barsoum 2006).

1.6 Prevention and Treatment

There is yet no effective vaccine against human parasitic diseases. The best method of eradication/control or prevention of the parasites is breaking their lifecycles. Good hygiene and sanitation with sufficient cooking or freezing of meat or fish, thorough cleaning and disinfection of vegetables before consumption, and drinking bottled purified water are also very efficient preventive measures. Parasitic diseases are often treatable and curable diseases. Some of the useful antiparasitic drugs are listed in Table 1.1 (Nakamura-Uchiyama et al. 2003). Treatment is usually straightforward using either broad spectrum or specific drugs, yet some species are drug-resistant.

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