

Parasitic and fungal infections of the CNS

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11.2.1 INTRODUCTION

There are a considerable number of parasitic infections that can involve the human Central Nervous System (including the brain, the spinal cord and the eyes). Of these, some infect the CNS as their primary infection site, but many others may only involve the CNS as an uncommon/rare complication or as an ectopic site of infection. Many of these infections are world-wide, some are confined to the tropics and others are more common in areas with poor hygiene and sanitation which are usually classed as developing areas – be they in temperate or tropical regions.

There are also a number of fungal pathogens and opportunists that can cause deep (systemic) mycotic infections which may involve the CNS. Most of these fungi have a wide geographical distribution although tending to result in sporadic infections only.

A summary of the better recognised parasites of the CNS and eyes are given in Table 1 below and details of the infections can be obtained from such excellent and detailed texts on tropical infections as that edited by Guerrant, Walker and Weller¹.

Table 11.2.1 Summary of parasites that may infect the CNS

Parasite /Fungus	Geog. Area	Mode of infection	Clinical association
Protozoa:			
<i>Acanthamoeba</i> sp	Widespread	Swimming/bathing	Meningoencephalitis Blindness
<i>Naegleria fowleri</i>	“	“	Meningoencephalitis
<i>Balamuthia mandrillaris</i>	“	“	“
<i>Entamoeba histolytica</i>	Tropics	Cyst ingestion	Brain abscess
<i>Trypanosoma gambiense</i>	C. W. Africa	Tsetse fly bite	Sleeping sickness
<i>T. rhodesiense</i>	E. C. Africa	“	“
<i>T. cruzi</i>	Latin America	Reduviid bite	Neurological complications. (Chagas' Disease)
<i>Plasmodium falciparum</i>	Tropics	<i>Anopheles</i> spp	Cerebral malaria
<i>Toxoplasma gondii</i>	World-wide	Food;water; (Cat contact)	Encephalitis; Brain calcifications; Blindness

Trematodes:

<i>Paragonimus</i> spp.	Africa;Asia; SE Asia; S. America	Eating crabs	Brain cysts
<i>Fasciola</i> spp	Widespread	Cercariae on Aquatic plants	Brain cysts
<i>Schistosoma</i> spp	Tropics	Water contact	Eggs/adults in CNS

Cestodes:

<i>Taenia solium</i> (<i>Cysticercus cellulosae</i>)	Widespread	Egg ingestion (human faeces)	Cerebral cysticercosis
<i>Echinococcus granulosus</i>	Widespread	Egg ingestion (dog faeces)	Cerebral hydatid
<i>Multiceps multiceps</i> (<i>Coenurus cerebralis</i>)	Widespread	Egg ingestion (dog faeces)	Cerebral cysts

Nematodes:

<i>Ascaris lumbricoides</i>	Widespread	Egg ingestion (human faeces)	Epilepsy
<i>Strongyloides stercoralis</i>	Widespread	Larval penetration	meningitis/ Abscesses.
<i>Toxocara</i> spp	Widespread	Egg ingestion (dog/cat faeces)	Epilepsy Blindness
<i>Baylisascaris</i> sp	USA	Egg ingestion	Meningoencephalitis
<i>Trichinella</i> spp	Widespread	Meat ingestion	Neuro. complications
<i>Angiostrongylus</i> spp	Tropics	Snail/slug ingestion	Eosinophilic meningitis
<i>Gnathostoma</i> sp	Widespread	Fish ingestion	“
<i>Dirofilaria immitis</i>	Tropics	Mosquito bite	“
<i>Loa loa</i>	W. Africa	Tabanid fly bite	Worm crosses eye
<i>Mansonella perstans</i> (<i>Meningonema peruzzi?</i>)	C. Africa	Biting midge ?	Coma
<i>Onchocerca volvulus</i>	C Africa; C. America	Simuliid bite	Blindness

Moulds:

<i>Aspergillus</i> spp.	Widespread	Inhalation	Brain abscess; Meningitis
<i>Mucor</i> spp. etc	“	“	Brain abscess

Yeasts:

<i>Cryptococcus neoformans</i>	Widespread	Inhalation	Meningitis
<i>Candida</i> spp.	“	“	Brain abscess; Meningitis

Dimorphic

<i>Coccidioides immitis</i> :	Eastern USA	Inhalation	Meningitis
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It is worth commenting on some of these parasitic infections:

11.2.2 PROTOZOAN INFECTIONS

Undoubtedly, cerebral malaria is the most important and must always be considered a medical emergency and diagnosis should be confirmed by blood slides or antigen tests. Most *P. falciparum* are drug resistant to some degree and treatment should be started without delay using such drugs as quinine - usually combined with doxycycline or Fansidar (pyrimethamine+sulfadoxine); Malarone (proguanil+atovaquone); mefloquine or artesunate^{1,2}.

African Sleeping Sickness is localised to Central Africa but is recorded in visitors to game parks. Diagnosis is based upon blood smears and treatment involves the use of toxic drugs such as suramin for early disease and melarsoprol for late disease (involving invasion of the CNS)¹.

Toxoplasmosis is world-wide in distribution, often with high levels of exposure in tropical or developing regions. Mostly it is asymptomatic or mild (toxoplasmosis) but may be severe (toxoplasmosis) involving the CNS and eyes in acquired disease in immunocompromised patients such as those with Aids where encephalitis is not uncommon, and in congenital toxoplasmosis where CNS involvement may result in encephalitis, hydrocephaly, intracerebral calcification, microcephaly, microphthalmia and blindness^{3,4}. Diagnosis is based on antibody serology and treatment utilises such drugs as pyrimethamine+sulphadiazine; spiramycin; co-trimoxazole or clindamycin².

11.2.3 HELMINTH INFECTIONS

Most Helminth infections of the CNS are uncommon complications resulting from adult worms reaching ectopic sites. In the case of schistosomiasis it may also result from egg deposition in the brain, spinal cord or eyes^{5,6}.

These often result in space occupying lesions of varying size (eg cysticercosis; hydatid) in brain, spine or eyes. Cerebral cysticercosis can cause personality changes leading to an erroneous diagnosis of rabies and is well recognised as a leading cause of epilepsy in Africa, India and Thailand. In the case of onchocerciasis, larvae invade the eye resulting in River Blindness⁵.

Diagnosis in most of these helminth infections is established by antibody serology but biopsy (contraindicated where hydatid is involved), X-rays, CT scans, and ultrasound all may have a role. In cases of eosinophilic meningitis, large numbers of eosinophils (or even nematode larvae) may be found in the CSF. Treatment may be surgical (hydatid and cysticercosis), use of anthelmintics (eg albendazole; ivermectin), or unavailable². For cysticercosis, treatment with anthelmintics such as albendazole should be combined with corticosteroid therapy to prevent a potentially fatal inflammatory response to the dying

cysticerci². It has even been claimed that anticysticercal drugs are not always needed and that they should not be given during the acute phase of severe cysticercotic encephalitis².

11.2.4 MYCOTIC INFECTIONS

Mycotic infections involving the CNS tend to develop in immunologically compromised or diabetic patients and are recorded widely but sporadically¹. Diagnosis is by fungal isolation from an appropriate clinical specimen or antigen testing of CSF. Treatment is with such antimycotic drugs as amphotericin B, ketoconazole, fluconazole or itraconazole⁷.

11.2.5 REFERENCES

1. Guerrant RL, Walker DH, Weller PF. (Eds) Essentials of Tropical Infectious Diseases. New York: Churchill Livingstone, 2001.
2. Sheorey H, Walker J, Biggs B-A. Clinical Parasitology. Melbourne: Melbourne University Press, 2000.
3. Mills A, Goldsmid JM. Intestinal protozoa. In: Doerr, W. and Siefert, G (Eds.). Tropical Pathology. Berlin: Springer-Verlag, 1995. pp 477 - 556
4. Goldsmid JM, Speare R, Bettiol S. The parasitology of foods. In: Foodborne Microorganisms of Public Health Significance. 6th ed. Hocking, A (Ed.) Waterloo. AIFST, 2003. pp 704 – 722.
5. Goldsmid JM, Mills A, Kibel M. Helminth infections. In: Textbook of Pediatrics. 6th edit. McIntosh, N., Helms, P. and Smyth, R. (Eds) Edinburgh: Churchill-Livingstone, 2003. pp 1475 - 1504
6. Hughes AJ, Biggs B-A. Parasitic worms of the central nervous system: An Australian perspective. Internal Med J. 2002; 32: 541-553.
7. Bartlett JG. Pocket Book of Infectious Disease Therapy. Philadelphia: Lippincott, Williams and Wilkins, 2002.

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