## Parasitic and fungal infections of the CNS

John M. Goldsmid

### 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 Weller.

### Table 11.2.1 Summary of parasites that may infect the CNS

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

- **Paragonimus spp.**
  - **Location:** Africa; Asia; SE Asia; S. America
  - **Transmission:** Eating crabs
  - **Symptoms:** Brain cysts

- **Fasciola spp.**
  - **Location:** Widespread
  - **Transmission:** Cercariae on Aquatic plants
  - **Symptoms:** Brain cysts

- **Schistosoma spp.**
  - **Location:** Tropics
  - **Transmission:** Water contact
  - **Symptoms:** Eggs/adults in CNS

### Cestodes:

- **Taenia solium** *(Cysticercus cellulosae)*
  - **Location:** Widespread
  - **Transmission:** Egg ingestion (human faeces)
  - **Symptoms:** Cerebral cysticercosis

- **Echinococcus granulosus**
  - **Location:** Widespread
  - **Transmission:** Egg ingestion (dog faeces)
  - **Symptoms:** Cerebral hydatid

- **Multiceps multiceps** *(Coenurus cerebralis)*
  - **Location:** Widespread
  - **Transmission:** Egg ingestion (dog faeces)
  - **Symptoms:** Cerebral cysts

### Nematodes:

- **Ascaris lumbricoides**
  - **Location:** Widespread
  - **Transmission:** Egg ingestion (human faeces)
  - **Symptoms:** Epilepsy

- **Strongyloides stercoralis**
  - **Location:** Widespread
  - **Transmission:** Larval penetration
  - **Symptoms:** meningitis/Abscesses.

- **Toxocara spp.**
  - **Location:** Widespread
  - **Transmission:** Egg ingestion (dog/cat faeces)
  - **Symptoms:** Epilepsy, Blindness

- **Baylisascaris sp.**
  - **Location:** USA
  - **Transmission:** Egg ingestion (human faeces)
  - **Symptoms:** Meningoencephalitis

- **Trichinella spp.**
  - **Location:** Widespread
  - **Transmission:** Meat ingestion
  - **Symptoms:** Neuro. complications

- **Angiostrongylus spp.**
  - **Location:** Tropics
  - **Transmission:** Snail/slugs
  - **Symptoms:** Eosinophilic meningitis

- **Gnathostoma sp.**
  - **Location:** Widespread
  - **Transmission:** Fish ingestion
  - **Symptoms:** Worm crosses eye

- **Dirofilaria immitis**
  - **Location:** Tropics
  - **Transmission:** Mosquito bite
  - **Symptoms:** Coma

- **Mansonella perstans** *(Meningonema peruzzi?)*
  - **Location:** C. Africa
  - **Transmission:** Biting midge
  - **Symptoms:** ?

- **Onchocerca volvulus**
  - **Location:** C Africa; C. America
  - **Transmission:** Simuliid bite
  - **Symptoms:** Blindness

### Moulds:

- **Aspergillus spp.**
  - **Location:** Widespread
  - **Transmission:** Inhalation
  - **Symptoms:** Brain abscess; Meningitis

- **Mucor spp. etc**
  - **Location:** “
  - **Transmission:** “
  - **Symptoms:** Brain abscess

### Yeasts:

- **Cryptococcus neoformans**
  - **Location:** Widespread
  - **Transmission:** Inhalation
  - **Symptoms:** Meningitis

- **Candida spp.**
  - **Location:** “
  - **Transmission:** “
  - **Symptoms:** Brain abscess; Meningitis

### Dimorphic

- **Coccidioides immitis:**
  - **Location:** Eastern USA
  - **Transmission:** Inhalation
  - **Symptoms:** Meningitis

---

PARASITIC AND FUNGAL INFECTIONS OF THE CNS
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 artesunate1,2.

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 (toxo-infection) but may be severe (toxo-disease) 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 blindness3,4. 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 eyes5,6.

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
cysticerci\(^2\). 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 encephalitis\(^2\).

### 11.2.4 MYCOTIC INFECTIONS

Mycotic infections involving the CNS tend to develop in immunologically compromised or diabetic patients and are recorded widely but sporadically\(^1\). 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 itraconazole\(^7\).

### 11.2.5 REFERENCES


