**AMEbic MENINGOECEPHALITIS, primary and granulomatous**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Adult dosage</th>
<th>Pediatric dosage</th>
</tr>
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<tbody>
<tr>
<td><strong>Naegleria</strong> Drug of choice: Amphoterin B(^1,2)</td>
<td>1.5 mg/kg/d IV in 2 doses x 3d, then 1 mg/kg/d x 6d plus 1.5 mg/d intrathecally x 2d, then 1 mg/d every other day x 8d</td>
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**Acanthamoeba** Drug of choice: Several patients with granulomatous amebic encephalitis (GAE) have been successfully treated with combinations of pentamidine, sulfadiazine, flucytosine, and either fluconazole oritraconazole.\(^3\) GAE in an AIDS patient was successfully treated with sulfadiazine, pyrimethamine and flucroconazole combined with surgical resection of the CNS lesion.\(^4\) Chronic Acanthamoeba meningitis was successfully treated in 2 children with a combination of oral trimethoprim/sulfamethoxazole, rifampin, and ketoconazole.\(^5\) Disseminated cutaneous infection in an immunocompromised patient was successfully treated with IV pentamidine, topical chlorhexidine and 2% ketoconazole cream, followed by oral itraconazole\(^6\) and with voriconazole and amphotericin B lipid complex.\(^7\) Other reports of successful therapy have been described.\(^8\) Susceptibility testing of Acanthamoeba isolates has shown differences in drug sensitivity between species and even among strains of a single species; antimicrobial susceptibility testing is advisable.\(^9\)

**Balamuthia mandrillaris** Drug of choice: *B. mandrillaris* is a free-living ameba that causes subacute to fatal granulomatous amebic encephalitis (GAE) and cutaneous disease. Two cases of Balamuthia encephalitis have been successfully treated with flucytosine, pentamidine, flucloxazole and sulfadiazine plus either azithromycin or clarithromycin (phenoxazinones were also used) combined with surgical resection of the CNS lesion.\(^10\) Another case was successfully treated following open biopsy with pentamidine, flucloxazole, sulfadiazine and clarithromycin.\(^11\)

**Sappinia diploidea** Drug of choice: A free-living ameba once thought not to be pathogenic to humans. *S. diploidea* has been successfully treated with azithromycin, pentamidine, itraconazole and flucytosine combined with surgical resection of the CNS lesion.\(^12\)

\(^\text{1. Availability problems. See table below.}\)

\(^\text{2. A Naegleria fowleri infection was treated successfully in a 9-year old girl with combination of amphotericin B and miconazole both intraventricular and intrathecal, plus oral rifampin (US Seidel et al NEJM 1982;306:346). Amphotericin B and miconazole appear to have synergistic effect, but Medical Letter consultants believe the rifampin might have had no additional effect (GS Visvesvara et al, FEMS Immunol Med Microbiol 2007; 50:1). Parenteral miconazole is no longer available in the US. Azithromycin has been used successfully in combination therapy to treat Balamuthia infection, but was changed to clarithromycin because of toxicity concerns and for better penetration into the cerebrospinal fluid. Azithromycin is more active than clarithromycin against Naegleria, so may be a better choice combined with amphotericin B for treatment of Naegleria (TR Deetz et al, Clin Infect Dis 2003; 37:1304; FL Schuster and GS Visvesvara, Drug Resistance Updates 2004; 7:41). A third case treated successfully with amphotericin B, sulfadiazine and rifampin (J Jain et al, Neurol India 2002; 50:470) and amphotericin B, flucloxazole and rifampin have also been published (J Vargas-Zepeda et al, Arch Med Research 2005; 36:83). Case reports of other successful therapy have been published (FL Schuster and GS Visvesvara, Int J Parasitol 2004; 34:1001), GS Visvesvar et al, FEMS Immunol Med Microbiol 2007; 50:1, epub Apr 11).\)

**Manufacturers of Drugs Used to Treat Parasitic Infections**

- Albendazole – Albenza (GlaxoSmithKline)
- Albena (GlaxoSmithKline) – albendazole
- Alinia (Romark) – nitzoxanide
- Ambisome (Gilead) – amphotericin B, liposomal amphotericin B – Fungizone (Apothecon), others
- amphotericin B, liposomal – Ambisome (Gilead)
- Ancobon (Valeant) – flucytosine
- § Antiminth (Pfizer) – pyrantel pamoate
- § Aralen (Sanofi) – chloroquine HCl and chloroquine phosphate
- § arteether – Arteam (Arenceo, Belgium)
- § arteether/lumefantrine – Coartem, Riamet (Novartis)
- § Artrenam (Arenceo, Belgium) – arteether
- § artesunate – “Guin No. 1 Factory, People’s Republic of China”
- atovaquone – Mepron (GlaxoSmithKline)
- atovaquone/proguanil – Malarone (GlaxoSmithKline)
- azithromycin – Zithromax (Pfizer), others
- § Bactrim (Roche) – TMP/Sulfa
- § benznidazole – Rochagan (Brazil)
- § Biaxin (Abbott) – clarithromycin
- § Bitricide (Bayer) – praziquantel
- § bithionol – Bitin (Tanabe, Japan)
- § Bitin (Tanabe, Japan) – bithionol
- § Brolene (Aventis, Canada) – propamidine isethionate
- chloroquine HCl and chloroquine phosphate – Aralen (Sanofi), others
- clarithromycin – Biaxin (Abbott), others
- Cleocin (Pfizer) – clindamycin
- clindamycin – Cleocin (Pfizer), others
- Coartem (Novartis) – arteether/lumefantrine
crotomatin – Eursa (Westwood-Squibb)
dapsone – (Jacobs)
- § Daraprim (GlaxoSmithKline) – pyrimethamine USP
t – diethylcarbamazine citrate (DEC) – Hetrazan
- § Diflucan (Pfizer) – fluconazole
- § diloxanide furoate – Furamide (Boots, United Kingdom)
doxycline – Vibramycin (Pfizer), others
t – efornithine (Difluoromethylornithine, DFMO) – Ornidyil (Aventis)
- § Egan (Novartis) – triclabendazole
- § Efite (Allergan) – permethrin
- § Ergamisol (Janssen) – levamisole
- § Eura (Westwood-Squibb) – crotomatin
- § Flagyl (Pfizer) – metronidazole
- § Fiasil (Sanofi-Aventis, France) – fumagillin
- § flucloxazole – Diflucan (Pfizer), others
- § flucytosine – Ancobon (Valeant)
- § fumagillin – Fiasil (Sanofi-Aventis, France)
- § Fungizone (Apothecon) – amphotericin
- § Furamide (Boots, United Kingdom) – diloxanide furoate
- § furazolidone – Furazole (Roberts)
- § Furozone (Roberts) – furazolidone
- § Germanin ( Bayer, Germany) – suramin sodium
- § Glucantine (Aventis, France) – meglumine antimonate
- § Hetrazan – diethylcarbamazine citrate (DEC)

(continued)
Humatin (Monarch) – paromomycin
§ Impavido (Zentaris, Germany) – miltefosine
§ iodoquinol – Yodoxin (Glenwood), others
§ itraconazole – Sporanox (Janssen-Ortho), others
§ ivermectin – Stromectol (Merk)
§ ketoconazole – Nizoral (Janssen), others
† Lamipt (Bayer, Germany) – nifurtimox
§ Lariam (Roche) – mefloquine
§ Leschutan (Teva, Israel) – topical paromomycin
§ levamisole – Ergamisol (Janssen)
§ lumefantrine/artemether – Coartem, Riamet
§ (Novartis)
† Malaron (GlaxoSmithKline) – atovaquone/proguanil
† malathion – Ovide (Medicis)
† mebendazole – Vermox (McNeil), others
† mefloquine – Lariam (Roche)
§ meglumine antimonate – Glucantime (Aventis, France)
† mepalosporol – Mel-B
† Mel-B – mepalosporol
† Mepron (GlaxoSmithKline) – atovaquone
§ metronidazole – Flagyl (Pfizer), others
§ miconazole – Monistat i.v.
§ miltefosine – Impavido (Zentaris, Germany)
§ Monistat i.v. – miconazole
† NebuPent (Fujisawa) – pentamidine isethionate
† niclosamide – Yomesan (Bayer, Germany)
† nifurtimox – Lampit (Bayer, Germany)
† nitazoxanide – Alinia (Romark)
† Nix (GlaxoSmithKline) – permethrin
† Nizoral (Janssen) – ketoconazole
§ ornidazole – Tibal (Roche, France)
† Ornidyil (Aventis) – efornithine
§ (Diffuromethylornithine, DFMO)
‡ Ovide (Medicis) – malathion
§ oxamnique – Vansil (Pfizer)
§ Paludrine (AstraZeneca, United Kingdom) – proguanil
§ paromomycin – Humatin (Monarch); Leschutan
§ (Teva, Israel; topical formulation not available in US)
† Pentam 300 (Fujisawa) – pentamidine isethionate
† pentamidine isethionate – Pentam 300 (Fujisawa), NebuPent (Fujisawa)
† Pentostam (GlaxoSmithKline, United Kingdom) – sodium stibogluconate
permethrin – Nix (GlaxoSmithKline), Elimite
permethrin – Nix (GlaxoSmithKline), Elmite
(Allergan)
§ pyrazinamide – Biltricide (Bayer)
§ primaquine phosphate USP
§ proguanil – Paludrine (AstraZeneca, United Kingdom)
§ proguanil/atovaquone – Malaron
† (GlaxoSmithKline)
§ propamidine isethionate – Brolene (Aventis, Canada)
§ pyrantel pamoate – Antiminth (Pfizer)
§ pyrethrins and piperonyl butoxide – RID (Pfizer), others
§ pyrimethamine USP – Daprim (GlaxoSmithKline)
§ Qualaquin – quinine sulfate (Mutual Pharmaceutical
§ Co/AR Scientific)
§ quinacrine
* quinidine gluconate (Eli Lilly)
§ quinine dihydrochloride
§ quinine sulfate – Qualaquin (Mutual Pharmaceutical
§ Co/AR Scientific)
† Riamet (Novartis) – artemether/lumefantrine
• RID (Pfizer) – pyrethrins and piperonyl butoxide
• Rifadin (Aventis) – rifampin
• rifampin – Rifadin (Aventis), others
§ Rochagan (Brazil) – benznidazole
* Rovamyine (Aventis) – spiramycin
† sodium stibogluconate – Pentostam
† (GlaxoSmithKline, United Kingdom)
* spiramycin – Rovamyine (Aventis)
§ Sporanox (Janssen-Ortho) – itraconazole
§ Stromectol (Merk) – ivermectin
§ sulfadiazine – (Eon)
† suramin sodium – Germanin (Bayer, Germany)
§ Tibal (Roche, France) – ornidazole
§ Tindamax (Mission) – tinidazole
§ TMP/Sulf – Bactrim (Roche), others
§ triclabendazole – Egaten (Novartis)
§ Vansil (Pfizer) – oxamnique
† Vermox (McNeil) – mebendazole
† Vibramycin (Pfizer) – doxycycline
† Yodoxin (Glenwood) – iodoquinol
§ Yomesan (Bayer, Germany) – niclosamide
† Zithromax (Pfizer) – azithromycin

* Available in the US only from the manufacturer.
§ Not available commercially. It may be obtained through compounding pharmacies such as Panorama Compounding Pharmacy,
§ 6744 Balboa Blvd, Van Nuys, CA 91406 (800-247-9767) or Medical Center Pharmacy, New Haven, CT (203-688-6816). Other com-
§ pounding pharmacies may be found through the National Association of Compounding Pharmacies (800-687-7850) or the
† Available from the CDC Drug Service, Centers for Disease Control and Prevention, Atlanta, Georgia 30333; 404-639-3670 (evenings,
† weekends, or holidays: 404-639-2888).
• Also available generically.

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