The Medical Letter®

On Drugs and Therapeutics

www.medletter.com

Published by The Medical Letter, Inc. • 1000 Main Street, New Rochelle, N.Y. 10801 • A Nonprofit Publication

April 2002

DRUGS FOR PARASITIC INFECTIONS

Parasitic infections are found throughout the world. With increasing travel, immigration, use of immunosuppressive drugs and the spread of AIDS, physicians anywhere may see infections caused by previously unfamiliar parasites. The table below lists first-choice and alternative drugs for most parasitic infections. The manufacturers of the drugs are listed on page 12.

Infection		Drug	Adult dosage	Pediatric dosage
Acanthamoeba keratitis				
Drug of choice:		See footnote 1		
AMEBIASIS *(Entamoeba histolytica)*				
asymptomatic				
Drug of choice:		Iodoquinol	650 mg tid x 20d	30-40 mg/kg/d (max. 2g) in 3 doses x 20d
	OR	Paromomycin	25-35 mg/kg/d in 3 doses x 7d	25-35 mg/kg/d in 3 doses x 7d
Alternative:		Diloxanide furoate[2]	500 mg tid x 10d	20 mg/kg/d in 3 doses x 10d
mild to moderate intestinal disease[3]				
Drug of choice:[4]		Metronidazole	500-750 mg tid x 7-10d	35-50 mg/kg/d in 3 doses x 7-10d
	OR	Tinidazole[5]	2 grams/d divided tid x 3d	50 mg/kg (max. 2g) qd x 3d
severe intestinal and extraintestinal disease[3]				
Drug of choice:		Metronidazole	750 mg tid x 7-10d	35-50 mg/kg/d in 3 doses x 7-10d
	OR	Tinidazole[5]	800 mg tid x 5d	60 mg/kg/d (max. 2 g) x 5d
AMEBIC MENINGOENCEPHALITIS, PRIMARY				
Naegleria				
Drug of choice:		Amphotericin B[6,7]	1 mg/kg/d IV, uncertain duration	1 mg/kg/d IV, uncertain duration
Acanthamoeba				
Drug of choice:		See footnote 8		

* Availability problems. See table on page 12.

1. For treatment of keratitis caused by *Acanthamoeba*, concurrent topical use of 0.1% propamidine isethionate *(Brolene)* plus neomycin-polymyxin B-gramicidin ophthalmic solution has been successful (SL Hargrave et al, Ophthalmology 1999; 106:952). In addition, 0.02% topical polyhexamethylene biguanide (PHMB) and/or chlorhexadine has been used successfully in a large number of patients (G Tabin et al, Cornea 2001; 20:757; YS Wysenbeek et al, Cornea 2000; 19:464). PHMB is available from Leiters Park Avenue Pharmacy, San Jose, CA (800-292-6773).
2. The drug is not available commercially, but as a service can be compounded by Medical Center Pharmacy, New Haven, CT (203-688-6816) or Panorama Compounding Pharmacy 6744 Balboa Blvd, Van Nuys, CA 91406 (800-247-9767).
3. Treatment should be followed by a course of iodoquinol or paromomycin in the dosage used to treat asymptomatic amebiasis.
4. Nitazoxanide (an investigational drug in the US manufactured by Romark Laboratories, Tampa, Florida, 813-282-8544, www.romarklabs.com) 500 mg bid x 3d is also effective for treatment of amebiasis (JF Rossignol et al, J Infect Dis 2001; 184:381).
5. A nitro-imidazole similar to metronidazole, but not marketed in the US, tinidazole appears to be at least as effective as metronidazole and better tolerated. Ornidazole, a similar drug, is also used outside the US.
6. A *Naegleria* infection was treated successfully with intravenous and intrathecal use of both amphotericin B and miconazole, plus rifampin (J Seidel et al, N Engl J Med 1982; 306:346). Other reports of successful therapy are questionable.
7. An approved drug, but considered investigational for this condition by the U.S. Food and Drug Administration.
8. Strains of *Acanthamoeba* isolated from fatal granulomatous amebic encephalitis are usually susceptible *in vitro* to pentamidine, ketoconazole *(Nizoral)*, flucytosine *(Ancobon)* and (less so) to amphotericin B. Chronic *Acanthamoeba* meningitis has been successfully treated in 2 children with a combination of oral trimethoprim/sulfamethoxazole, rifampin and ketoconazole (T Singhal et al, Pediatr Infect Dis J 2001; 20:623), and in an AIDS patient with fluconazole and sulfadiazine combined with surgical resection of the CNS lesion (M Seijo Martinez et al, J Clin Microbiol 2000; 38:3892). Disseminated cutaneous infection in an immunocompromised patient has been treated successfully with IV pentamidine isethionate, topical chlorhexidine and 2% ketoconazole cream, followed by oral itraconazole *(Sporanox)* (CA Slater et al, N Engl J Med 1994; 331:85).

Founded 1959 by Arthur Kallet and Harold Aaron, M.D. (ISSN 1523-2859)

Infection	Drug	Adult dosage	Pediatric dosage
AMEBIC MENINGOENCEPHALITIS, PRIMARY *(continued)*			
Balamuthia mandrillaris			
Drug of choice:	See footnote 9		
Sappinia diploidea			
Drug of choice:	See footnote 10		
ANCYLOSTOMA caninum (Eosinophilic enterocolitis)			
Drug of choice:	Albendazole[7]	400 mg once	400 mg once
OR	Mebendazole	100 mg bid x 3d	100 mg bid x 3d
OR	Pyrantel pamoate[7]	11 mg/kg (max. 1g) x 3d	11 mg/kg (max. 1g) x 3d
OR	Endoscopic removal		
Ancylostoma duodenale, see HOOKWORM			
ANGIOSTRONGYLIASIS			
Angiostrongylus cantonensis			
Drug of choice:	See footnote 11		
Angiostrongylus costaricensis			
Drug of choice:	See footnote 12		
ANISAKIASIS *(Anisakis)*			
Treatment of choice:	Surgical or endoscopic removal		
ASCARIASIS (*Ascaris lumbricoides*, roundworm)			
Drug of choice:	Albendazole[7]	400 mg once	400 mg once
OR	Mebendazole	100 mg bid x 3d or 500 mg once	100 mg bid x 3d or 500 mg once
OR	Pyrantel pamoate[7]	11 mg/kg once (max. 1 gram)	11 mg/kg once (max. 1 gram)
BABESIOSIS *(Babesia microti)*			
Drugs of choice:[13]	Clindamycin[7]	1.2 grams bid IV or 600 mg tid PO x 7-10d	20-40 mg/kg/d PO in 3 doses x 7d
	plus quinine	650 mg tid PO x 7d	25 mg/kg/d PO in 3 doses x 7d
OR	Atovaquone[7]	750 mg bid x 7-10d	20 mg/kg bid x 7-10d
	plus azithromycin[7]	600 mg PO daily x 7-10d	12 mg/kg daily x 7-10d
Balamuthia mandrillaris, see AMEBIC MENINGOENCEPHALITIS, PRIMARY			
BALANTIDIASIS *(Balantidium coli)*			
Drug of choice:	Tetracycline[7,14]	500 mg qid x 10d	40 mg/kg/d (max. 2 g) in 4 doses x 10d
Alternatives:	Metronidazole[7]	750 mg tid x 5d	35-50 mg/kg/d in 3 doses x 5d
	Iodoquinol[7]	650 mg tid x 20d	40 mg/kg/d in 3 doses x 20d
BAYLISASCARIASIS *(Baylisascaris procyonis)*			
Drug of choice:	See footnote 15		
BLASTOCYSTIS *hominis* infection			
Drug of choice:	See footnote 16		
CAPILLARIASIS *(Capillaria philippinensis)*			
Drug of choice:	Mebendazole[7]	200 mg bid x 20d	200 mg bid x 20d
Alternatives:	Albendazole[7]	400 mg daily x 10d	400 mg daily x 10d
Chagas' disease, see TRYPANOSOMIASIS			
Clonorchis sinensis, see FLUKE infection			

* Availability problems. See table on page 12.

9. A free-living leptomyxid ameba that causes subacute to chronic granulomatous CNS disease. *In vitro* pentamidine isethionate 10 μg/ml is amebastatic (CF Denney et al, Clin Infect Dis 1997; 25:1354). One patient, according to Medical Letter consultants, was successfully treated with clarithromycin (*Biaxin)* 500 mg t.i.d., fluconazole *(Diflucan)* 400 mg once daily, sulfadiazine 1.5 g q6h and flucytosine *(Ancobon)* 1.5 g q6h.
10. A recently described free-living ameba not previously known to be pathogenic to humans. It was successfully treated with azithromycin, IV pentamidine, itraconazole and flucytosine (BB Gelman et al, JAMA 2001; 285:2450).
11. Most patients have a self-limited course and recover completely. Analgesics, corticosteroids, and careful removal of CSF at frequent intervals can relieve symptoms (FD Pien and BC Pien, Int J Infect Dis 1999; 3:161; V Lo Re and SJ Gluckman, Clin Infect Dis 2001; 33:e112). In a recent report, mebendazole and a glucocorticosteroid appeared to shorten the course of infection (H-C Tsai et al, Am J Med 2001; 111:109). No drug is proven to be effective and some patients have worsened when given thiabendazole, albendazole, mebendazole or ivermectin.
12. Mebendazole has been used in experimental animals.
13. Exchange transfusion has been used in severely ill patients and those with high (>10%) parasitemia (JC Hatcher et al, Clin Infect Dis 2001; 32:1117). Combination therapy with atovaquone and azithromycin is as effective as clindamycin/quinine and may be better tolerated (PJ Krause et al, N Engl J Med 2000; 343:1454). Concurrent use of pentamidine and trimethoprim-sulfamethoxazole has been reported to cure an infection with *B. divergens*, the most common *Babesia* species in Europe (D Raoult et al, Ann Intern Med 1987; 107:944).
14. Use of tetracyclines is contraindicated in pregnancy and in children less than 8 years old.
15. No drugs have been demonstrated to be effective. Albendazole 25 mg/kg/d x 10d started up to 3d after possible infection might prevent clinical disease and is recommended for children with known exposure (ingestion of racoon stool or contaminated soil) (MMWR Morb Mortal Wkly Rep 2002; 50:1153). Mebendazole, thiabendazole, levamisole *(Ergamisol)* and ivermectin could also be tried. Steroid therapy may be helpful, especially in eye and CNS infections. Ocular baylisascariasis has been treated successfully using laser photocoagulation therapy to destroy the intraretinal larvae.
16. Clinical significance of these organisms is controversial, but metronidazole 750 mg tid x 10d or iodoquinol 650 mg tid x 20d has been reported to be effective (DJ Stenzel and PFL Borenam, Clin Microbiol Rev 1996; 9:563). Metronidazole resistance may be common (K Haresh et al, Trop Med Int Health 1999; 4:274). Trimethoprim-sulfamethoxazole is an alternative regimen (UZ Ok et al, Am J Gastroenterol 1999; 94:3245).

Infection		Drug	Adult dosage	Pediatric dosage
CRYPTOSPORIDIOSIS *(Cryptosporidium)*				
Drug of choice:		See footnote 17		
CUTANEOUS LARVA MIGRANS (creeping eruption, dog and cat hookworm)				
Drug of choice:[18]		Albendazole[7]	400 mg daily x 3d	400 mg daily x 3d
	OR	Ivermectin[7]	200 μg/kg daily x 1-2d	200 μg/kg daily x 1-2d
	OR	Thiabendazole	Topically	Topically
CYCLOSPORA infection				
Drug of choice:[19]		Trimethoprim-sulfamethoxazole[7]	TMP 160 mg, SMX 800 mg bid x 7-10d	TMP 5 mg/kg, SMX 25 mg/kg bid x 7-10d
CYSTICERCOSIS, see TAPEWORM infection				
DIENTAMOEBA *fragilis* infection				
Drug of choice:		Iodoquinol	650 mg tid x 20d	30-40 mg/kg/d (max. 2g) in 3 doses x 20d
	OR	Paromomycin[7]	25-35 mg/kg/d in 3 doses x 7d	25-35 mg/kg/d in 3 doses x 7d
	OR	Tetracycline[7,14]	500 mg qid x 10d	40 mg/kg/d (max. 2g) in 4 doses x 10d
	OR	Metronidazole	500-750 mg tid x 10d	20-40 mg/kg/d in 3 doses x 10d
Diphyllobothrium latum, see TAPEWORM infection				
DRACUNCULUS *medinensis* (guinea worm) infection				
Drug of choice:		Metronidazole[7,20]	250 mg tid x 10d	25 mg/kg/d (max. 750 mg) in 3 doses x 10d
Echinococcus, see TAPEWORM infection				
Entamoeba histolytica, see AMEBIASIS				
ENTAMOEBA *polecki* infection				
Drug of choice:		Metronidazole[7]	750 mg tid x 10d	35-50 mg/kg/d in 3 doses x 10d
ENTEROBIUS *vermicularis* (pinworm) infection				
Drug of choice:[21]		Pyrantel pamoate	11 mg/kg base once (max. 1 gram); repeat in 2 weeks	11 mg/kg base once (max. 1 gram); repeat in 2 weeks
	OR	Mebendazole	100 mg once; repeat in 2 weeks	100 mg once; repeat in 2 weeks
	OR	Albendazole[7]	400 mg once; repeat in 2 weeks	400 mg once; repeat in 2 weeks
Fasciola hepatica, see FLUKE infection				
FILARIASIS[22]				
Wuchereria bancrofti, Brugia malayi, Brugia timori				
Drug of choice:[23,24]		Diethylcarbamazine[25*]	Day 1: 50 mg, p.c. Day 2: 50 mg tid Day 3: 100 mg tid Days 4 through 14: 6 mg/kg/d in 3 doses	Day 1: 1 mg/kg p.c. Day 2: 1 mg/kg tid Day 3: 1-2 mg/kg tid Days 4 through 14: 6 mg/kg/d in 3 doses
Loa loa				
Drug of choice:[24,26]		Diethylcarbamazine[25*]	Day 1: 50 mg p.c. Day 2: 50 mg tid Day 3: 100 mg tid Days 4 through 21: 9 mg/kg/d in 3 doses	Day 1: 1 mg/kg p.c. Day 2: 1 mg/kg tid Day 3: 1-2 mg/kg tid Days 4 through 21: 9 mg/kg/d in 3 doses

* Availability problems. See table on page 12.

17. Three days of treatment with nitazoxanide (see footnote 4) may be useful for treating cryptosporidial diarrhea in immunocompetent patients. The recommended dose in adults is 500 mg bid, in children 4-11 years old, 200 mg bid, and in children 1-3 years old, 100 mg bid (JA Rossignol et al, J Infect Dis 2001; 184:103). A small randomized, double-blind trial in symptomatic HIV-infected patients found paromomycin similar to placebo (RG Hewitt et al, Clin Infect Dis 2000; 3:1084).
18. G Albanese et al, Int J Dermatol 2001; 40:67.
19. HIV infected patients may need higher dosage and long-term maintenance. In cases of cotrimoxazole intolerance, ciprofloxacin 500 mg bid x 7d has been effective (R-I Verdier et al, Ann Intern Med 2000; 132:885).
20. Not curative, but decreases inflammation and facilitates removing the worm. Mebendazole 400-800 mg/d for 6d has been reported to kill the worm directly.
21. Since all family members are usually effected, treatment of the entire household is recommended.
22. Endosymbiotic *Wolbachia* bacteria may have a role in filarial development and host response, and may represent a new target for therapy (HF Cross et al, Lancet 2001; 358:1873). Doxycycline 100 mg daily x 6 weeks has eradicated *Wolbachia* and led to sterility of adult worms in onchocerciasis (A Hoerauf et al, Lancet 2000; 355:1241).
23. Most symptoms caused by the adult worm. Single-dose combination of albendazole (400 mg) with either ivermectin (200 μg/kg) or diethylcarbamazine (6 mg/kg) is effective for reduction or suppression of *W. bancrofti* microfilaremia (MM Ismail et al, Trans R Soc Trop Med Hyg 2001; 95:332; TB Nutman, Curr Opin Infect Dis 2001; 14:539).
24. Antihistamines or corticosteroids may be required to decrease allergic reactions due to disintegration of microfilariae in treatment of filarial infections, especially those caused by *Loa loa*.
25. For patients with no microfilariae in the blood, full doses can be given from day one.
26. In heavy infections with *Loa loa*, rapid killing of microfilariae can provoke an encephalopathy. Apheresis has been reported to be effective in lowering microfilarial counts in patients heavily infected with *Loa loa* (EA Ottesen, Infect Dis Clin North Am 1993; 7:619). Albendazole or ivermectin have also been used to reduce microfilaremia; albendazole is preferred because of its slower onset of action (AD Klion et al, J Infect Dis 1993; 168:202; M Kombila et al, Am J Trop Med Hyg 1998; 58:458). Albendazole may be useful for treatment of loiasis when diethylcarbamazine is ineffective or cannot be used but repeated courses may be necessary (AD Klion et al, Clin Infect Dis 1999; 29:680). Diethylcarbamazine, 300 mg once weekly, has been recommended for prevention of loiasis (TB Nutman et al, N Engl J Med 1988; 319:752).

Infection	Drug	Adult dosage	Pediatric dosage
FILARIASIS *(continued)*			
Mansonella ozzardi			
Drug of choice:[24]	See footnote 27		
Mansonella perstans			
Drug of choice:[24]	Mebendazole[7]	100 mg bid x 30d	100 mg bid x 30d
OR	Albendazole[7]	400 mg bid x 10d	400 mg bid x 10d
Mansonella streptocerca			
Drug of choice:[24,28]	Diethylcarbamazine*	6 mg/kg/d x 14d	6 mg/kg/d x 14d
	Ivermectin[7]	150 μg/kg once	150 μg/kg once
Tropical Pulmonary Eosinophilia (TPE)			
Drug of choice:	Diethylcarbamazine*	6 mg/kg/d in 3 doses x 21d	6 mg/kg/d in 3 doses x 21d
Onchocerca volvulus (River blindness)			
Drug of choice:	Ivermectin[29]	150 μg/kg once, repeated every 6 to 12 months until asymptomatic	150 μg/kg once, repeated every 6 to 12 months until asymptomatic
FLUKE, hermaphroditic, infection			
Clonorchis sinensis **(Chinese liver fluke)**			
Drug of choice:	Praziquantel	75 mg/kg/d in 3 doses x 1d	75 mg/kg/d in 3 doses x 1d
OR	Albendazole[7]	10 mg/kg x 7d	10 mg/kg x 7d
Fasciola hepatica **(sheep liver fluke)**			
Drug of choice:[30]	Triclabendazole*	10 mg/kg once	10 mg/kg once
Alternative:	Bithionol*	30-50 mg/kg x 10-15 doses	30-50 mg/kg on alternate days x 10-15 doses
Fasciolopsis buski, Heterophyes heterophyes, Metagonimus yokogawai **(intestinal flukes)**			
Drug of choice:	Praziquantel[7]	75 mg/kg/d in 3 doses x 1d	75 mg/kg/d in 3 doses x 1d
Metorchis conjunctus **(North American liver fluke)**[31]			
Drug of choice:	Praziquantel[7]	75 mg/kg/d in 3 doses x 1d	75 mg/kg/d in 3 doses x 1d
Nanophyetus salmincola			
Drug of choice:	Praziquantel[7]	60 mg/kg/d in 3 doses x 1d	60 mg/kg/d in 3 doses x 1d
Opisthorchis viverrini **(Southeast Asian liver fluke)**			
Drug of choice:	Praziquantel	75 mg/kg/d in 3 doses x 1d	75 mg/kg/d in 3 doses x 1d
Paragonimus westermani **(lung fluke)**			
Drug of choice:	Praziquantel[7]	75 mg/kg/d in 3 doses x 2d	75 mg/kg/d in 3 doses x 2d
Alternative:[32]	Bithionol*	30-50 mg/kg on alternate days x 10-15 doses	30-50 mg/kg on alternate days x 10-15 doses
GIARDIASIS (*Giardia lamblia*)			
Drug of choice:	Metronidazole[7]	250 mg tid x 5d	15 mg/kg/d in 3 doses x 5d
Alternatives:[33]	Quinacrine[2]	100 mg tid x 5d (max. 300 mg/d)	2 mg/kg tid x 5d (max. 300 mg/d)
	Tinidazole[5]	2 grams once	50 mg/kg once (max. 2 g)
	Furazolidone	100 mg qid x 7-10d	6 mg/kg/d in 4 doses x 7-10d
	Paromomycin[7,34]	25-35 mg/kg/d in 3 doses x 7d	25-35 mg/kg/d in 3 doses x 7d
GNATHOSTOMIASIS *(Gnathostoma spinigerum)*			
Treatment of choice:[35]	Albendazole[7]	400 mg bid x 21d	400 mg bid x 21d
OR	Ivermectin[7]	200 μg/kg/d x 2d	200 μg/kg/d x 2d
OR	Surgical removal		
GONGYLONEMIASIS *(Gongylonema sp.)*			
Treatment of choice:	Surgical removal		
OR	Albendazole[7, 36]	10 mg/kg/d x 3 d	10 mg/kg/d x 3 d

* Availability problems. See table on page 12.

27. Diethylcarbamazine has no effect. Ivermectin, 200 μg/kg once, has been effective.
28. Diethylcarbamazine is potentially curative due to activity against both adult worms and microfilariae. Ivermectin is only active against microfilariae.
29. Annual treatment with ivermectin 150 μg/kg can prevent blindness due to ocular onchocerciasis (D Mabey et al, Ophthalmology 1996; 103:1001).
30. Unlike infections with other flukes, *Fasciola hepatica* infections may not respond to praziquantel. Triclabendazole, a veterinary fasciolide, may be safe and effective but data are limited (CS Graham et al, Clin Infect Dis 2001; 33:1). It is available from Victoria Pharmacy, Zurich, Switzerland, 41-1-211-24-32. It should be given with food for better absorption.
31. JD MacLean et al, Lancet 1996; 347:154.
32. Triclabendazole may be effective in a dosage of 5 mg/kg once daily for 3 days or 10 mg/kg twice in one day (M Calvopiña et al, Trans R Soc Trop Med Hyg 1998; 92:566). See footnote 30.
33. In one study, nitazoxanide (see footnote 4) was as effective as metronidazole and has been used successfully in high doses to treat a case of *Giardia* resistant to metronidazole and albendazole (JJ Ortiz et al, Aliment Pharmacol Ther 2001; 15:1409; P Abboud et al, Clin Infect Dis 2001; 32:1792). Albendazole 400 mg daily x 5d may be effective (A Hall and Q Nahar, Trans R Soc Trop Med Hyg 1993; 87:84; AK Dutta et al, Indian J Pediatr 1994; 61:689). Bacitracin zinc or bacitracin 120,000 U bid for 10 days may also be effective (BJ Andrews et al, Am J Trop Med Hyg 1995; 52:318). Combination treatment with standard doses of metronidazole and quinacrine given for 3 weeks has been effective for a small number of refractory infections (TE Nash et al, Clin Infect Dis 2001; 33:22).
34. Not absorbed; may be useful for treatment of giardiasis in pregnancy.
35. F Chappuis et al, Clin Infect Dis 2001; 33:e17; P Nontasut et al, Southeast Asian J Trop Med Public Health 2000; 31:374.
36. One patient has been successfully treated with albendazole (ML Eberhard and C Busillo, Am J Trop Med Hyg 1999; 61:51).

Infection		Drug	Adult dosage	Pediatric dosage
HOOKWORM infection *(Ancylostoma duodenale, Necator americanus)*				
Drug of choice:		Albendazole[7]	400 mg once	400 mg once
	OR	Mebendazole	100 mg bid x 3d or 500 mg once	100 mg bid x 3d or 500 mg once
	OR	Pyrantel pamoate[7]	11 mg/kg (max. 1g) x 3d	11 mg/kg (max. 1g) x 3d
Hydatid cyst, see TAPEWORM infection				
Hymenolepis nana, see TAPEWORM infection				
ISOSPORIASIS *(Isospora belli)*				
Drug of choice:[37]		Trimethoprim-sulfamethoxazole[7]	160 mg TMP, 800 mg SMX bid x 10d	TMP 5 mg/kg, SMX 25 mg/kg bid x 10d
LEISHMANIASIS[38]				
Drug of choice:[39]		Sodium stibogluconate*	20 mg Sb/kg/d IV or IM x 20-28d[40]	20 mg Sb/kg/d IV or IM x 20-28d[40]
	OR	Meglumine antimonate*	20 mg Sb/kg/d IV or IM x 20-27d[40]	20 mg Sb/kg/d IV or IM x 20-28d[40]
	OR	Amphotericin B[7]	0.5 to 1 mg/kg IV daily or every 2d for up to 8 wks	0.5 to 1 mg/kg IV daily or every 2d for up to 8 wks
	OR	Liposomal Amphotericin B[41]	3 mg/kg/d (days 1-5) and 3 mg/kg/d days 14, 21[42]	3 mg/kg/d (days 1-5) and 3 mg/kg/d days 14, 21[42]
Alternatives:		Pentamidine	2-4 mg/kg daily or every 2d IV or IM for up to 15 doses[43]	2-4 mg/kg daily or every 2d IV or IM for up to 15 doses[43]
	OR	Paromomycin[44]*	Topically 2x/d x 10-20d	
LICE infestation *(Pediculus humanus, P. capitis, Phthirus pubis)*[45]				
Drug of choice:		1% Permethrin[46]	Topically	Topically
	OR	0.5% Malathion[47]	Topically	Topically
Alternative:		Pyrethrins with piperonyl butoxide[46]	Topically	Topically
	OR	Ivermectin[7, 48]	200 μg/kg once	200 μg/kg once
Loa loa, see FILARIASIS				

* Availability problems. See table on page 12.

37. Immunosuppressed patients: TMP/SMX qid x 10d followed by bid x 3 weeks. In sulfonamide-sensitive patients, pyrimethamine 50-75 mg daily in divided doses has been effective. HIV-infected patients may need long-term maintenance. Ciprofloxacin 500 mg bid x 7d has also been effective (R-I Verdier et al, Ann Intern Med 2000; 132:885).
38. Treatment dosage and duration vary based on the disease symptoms, host immune status, species, and the area of the world where infection was acquired. Cutaneous infection is due to *L. mexicana, L. tropica, L. major, L. braziliensis*; mucocutaneous is mostly due to *L. braziliensis*, and visceral is due to *L. donovani* (Kala-azar), *L. infantum, L. chagasi*. Dosage range listed includes many, but not all possibilities.
39. For treatment of kala-azar, oral miltefosine 100 mg daily for 4 weeks was 97% effective after 6 months in one study. Gastrointestinal adverse effects are common and the drug is contraindicated in pregnancy (TK Jha et al, N Engl J Med 1999; 341:1795). In an uncontrolled trial, oral miltefosine was effective for the treatment of American cutaneous leishmaniasis at a dosage of about 2.25 mg/kg/day for 3-4 wks. "Motion sickness" was the most frequent adverse effect (J Soto et al, Clin Infect Dis 2001; 33:e57).
40. May be repeated or continued. A longer duration may be needed for some forms of visceral leishmaniasis (BL Herwaldt, Lancet 1999; 354:1191).
41. Three preparations of lipid-encapsulated amphotericin B have been used for treatment of visceral leishmaniasis. Largely based on clinical trials in patients infected with *L. infantum*, the FDA approved liposomal amphotericin B *(AmBisome)* for treatment of visceral leishmaniasis (A Meyerhoff, Clin Infect Dis 1999; 28:42; JD Berman, Clin Infect Dis 1999; 28:49). Amphotericin B lipid complex *(Abelcet)* and amphotericin B cholesteryl sulfate *(Amphotec)* have also been used with good results. Limited data in a few patients suggest that liposomal amphotericin B may also be effective for mucocutaneous disease (VS Amato et al, J Antimicrob Chemother 2000; 46:341; RNR Sampaio and PD Marsden, Trans R Soc Trop Med Hyg 1997; 91:77). Some studies indicate that *L. donovani* resistant to pentavalent antimonial agents may respond to lipid-encapsulated amphotericin B (S Sundar et al, Ann Trop Med Parasitol 1998; 92:755).
42. The dose for immunocompromised patients with HIV is 4 mg/kg/d (days 1-5) and 4 mg/kg/d on days 10,17,24,31,38. The relapse rate is high, suggesting that maintenance therapy may be indicated.
43. For *L. donovani*: 4 mg/kg once/day x 15 doses; for cutaneous disease: 2 mg/kg once/day x 7 or 3 mg/kg once/day x 4 doses.
44. Topical paromomycin can only be used in geographic regions where cutaneous leishmaniasis species have low potential for mucosal spread. A formulation of 15% paromomycin and 12% methylbenzethonium chloride *(Leshcutan)* in soft white paraffin for topical use, has been reported to be effective in some patients against cutaneous leishmaniasis due to *L. major* (O Ozgoztasi and I Baydar, Int J Dermatol 1997; 36:61; BA Arana et al, Am J Trop Med Hyg 2001; 65:466).
45. For infestation of eyelashes with crab lice, use petrolatum. For pubic lice, treat with 5% permethrin or ivermectin as for scabies (see page 9).
46. A second application is recommended one week later to kill hatching progeny. Some lice are resistant to pyrethrins and permethrin (RJ Pollack, Arch Pediatr Adolesc Med 1999; 153:969).
47. RJ Roberts et al, Lancet 2000; 356:540.
48. Ivermectin is effective against adult lice but has no effect on nits (TA Bell, Pediatr Infect Dis J 1998; 17:923).

Infection	Drug	Adult dosage	Pediatric dosage
MALARIA, Treatment of (*Plasmodium falciparum, P. ovale, P. vivax*, and *P. malariae*)			
Chloroquine-resistant *P. falciparum*[49]			
ORAL			
Drugs of choice:	Quinine sulfate	650 mg q8h x 3-7d[50]	25mg/kg/d in 3 doses x 3-7d[50]
	plus		
	doxycycline[7,14]	100 mg bid x 7d	2 mg/kg/d x 7d
	or plus		
	tetracycline[7,14]	250 mg qid x 7d	6.25 mg/kg qid x 7d
	or plus		
	pyrimethamine-sulfadoxine[51]	3 tablets at once on last day of quinine	<1 yr: ¼ tablet 1-3 yrs: ½ tablet 4-8 yrs: 1 tablet 9-14 yrs: 2 tablets
	or plus		
	clindamycin[7,52]	900 mg tid x 5d	20-40 mg/kg/d in 3 doses x 5d
	OR Atovaquone/ proguanil[53]	2 adult tablets bid x 3d	11-20 kg: 1 adult tablet/day x 3d 21-30 kg: 2 adult tablets/day x 3d 31-40 kg: 3 adult tablets/day x 3d >40 kg: 2 adult tablets bid x 3d
Alternatives:[54]	Mefloquine[55, 56]	750 mg followed by 500 mg 12 hrs later	<45 kg: 15 mg/kg PO followed by 10 mg/kg PO 8-12 hours later
	Halofantrine[57]*	500 mg q6h x 3 doses; repeat in 1 week[58]	<40 kg: 8 mg/kg q6h x 3 doses; repeat in 1 week[58]
	OR Artesunate[59]*	4 mg/kg/d x 3d	
	plus		
	mefloquine[55, 56]	750 mg followed by 500 mg 12 hrs later	15 mg/kg followed 8-12 hrs later by 10 mg/kg
Chloroquine-resistant *P. vivax*[60]			
Drug of choice:	Quinine sulfate	650 mg q8h x 3-7d[50]	25 mg/kg/d in 3 doses x 3-7d[50]
	plus		
	doxycycline[7,14]	100 mg bid x 7d	2 mg/kg/d x 7d
	OR Mefloquine[55,56]	750 mg followed by 500 mg 12 hr later	15 mg/kg followed 8-12 hrs later by 10 mg/kg
Alternatives:	Halofantrine[57, 61]*	500 mg q6h x 3 doses	8 mg/kg q6h x 3 doses
	Chloroquine	25 mg base/kg in 3 doses over 48 hrs	
	plus		
	primaquine[62]	2.5 mg base/kg in 3 doses over 48 hrs	

* Availability problems. See table on page 12.

49. Chloroquine-resistant *P. falciparum* occur in all malarious areas except Central America west of the Panama Canal Zone, Mexico, Haiti, the Dominican Republic, and most of the Middle East (chloroquine resistance has been reported in Yemen, Oman, Saudi Arabia and Iran).
50. In Southeast Asia, relative resistance to quinine has increased and the treatment should be continued for 7 days.
51. *Fansidar* tablets contain 25 mg of pyrimethamine and 500 mg of sulfadoxine. Resistance to pyrimethamine-sulfadoxine has been reported from Southeast Asia, the Amazon basin, sub-Saharan Africa, Bangladesh and Oceania.
52. For use in pregnancy.
53. Atovaquone plus proguanil is available as a fixed-dose combination tablet: adult tablets (250 mg atovaquone/100 mg proguanil, *Malarone)* and pediatric tablets (62.5 mg atovaquone/25 mg proguanil, *Malarone Pediatric*). To enhance absorption, it should be taken within 45 minutes after eating (S Looareesuwan et al, Am J Trop Med Hyg 1999; 60:533). Although approved for once daily dosing, to decrease nausea and vomiting the dose for treatment is usually divided in two.
54. For treatment of multiple-drug-resistant *P. falciparum* in Southeast Asia, especially Thailand, where resistance to mefloquine and halofantrine is frequent, a 7-day course of quinine and tetracycline is recommended (G Watt et al, Am J Trop Med Hyg 1992; 47:108). Artesunate plus mefloquine (C Luxemburger et al, Trans R Soc Trop Med Hyg 1994; 88:213), artemether plus mefloquine (J Karbwang et al, Trans R Soc Trop Med Hyg 1995; 89:296), mefloquine plus doxycycline or atovaquone/proguanil may also be used to treat multiple-drug-resistant *P. falciparum*.
55. At this dosage, adverse effects including nausea, vomiting, diarrhea, dizziness, disturbed sense of balance, toxic psychosis and seizures can occur. Mefloquine is teratogenic in animals and should not be used for treatment of malaria in pregnancy. It should not be given together with quinine, quinidine or halofantrine, and caution is required in using quinine, quinidine or halofantrine to treat patients with malaria who have taken mefloquine for prophylaxis. The pediatric dosage has not been approved by the FDA. Resistance to mefloquine has been reported in some areas, such as the Thailand-Myanmar and -Cambodia borders and in the Amazon basin, where 25 mg/kg should be used.
56. In the US, a 250-mg tablet of mefloquine contains 228 mg mefloquine base. Outside the US, each 275-mg tablet contains 250 mg base.
57. May be effective in multiple-drug-resistant *P. falciparum* malaria, but treatment failures and resistance have been reported, and the drug has caused lengthening of the PR and QTc intervals and fatal cardiac arrhythmias. It should not be used for patients with cardiac conduction defects or with other drugs that may affect the QT interval, such as quinine, quinidine and mefloquine. Cardiac monitoring is recommended. Variability in absorption is a problem; halofantrine should not be taken one hour before to two hours after meals because food increases its absorption. It should not be used in pregnancy.
58. A single 250-mg dose can be used for repeat treatment in mild to moderate infections (JE Touze et al, Lancet 1997; 349:255).
59. K Na-Bangchang, Trop Med Int Health 1999; 4:602.
60. *P. vivax* with decreased susceptibility to chloroquine is a significant problem in Papua-New Guinea and Indonesia. There are also a few reports of resistance from Myanmar, India, Thailand, the Solomon Islands, Vanuatu, Guyana, Brazil, Colombia and Peru.
61. JK Baird el al, J Infect Dis 1995; 171:1678.
62. Primaquine phosphate can cause hemolytic anemia, especially in patients whose red cells are deficient in glucose-6-phosphate dehydrogenase. This deficiency is most common in African, Asian and Mediterranean peoples. Patients should be screened for G-6-PD deficiency before treatment. Primaquine should not be used during pregnancy.

Infection		Drug	Adult dosage	Pediatric dosage
MALARIA, Treatment of *(continued)*				
All *Plasmodium* except Chloroquine-resistant *P. falciparum*[49] and Chloroquine-resistant *P. vivax*[60]				
ORAL				
Drug of choice:		Chloroquine phosphate[63]	1 gram (600 mg base), then 500 mg (300 mg base) 6 hrs later, then 500 mg (300 mg base) at 24 and 48 hrs	10 mg base/kg (max. 600 mg base), then 5 mg base/kg 6 hrs later, then 5 mg base/kg at 24 and 48 hrs
All *Plasmodium*				
PARENTERAL				
Drug of choice:[64]		Quinidine gluconate[65]	10 mg/kg loading dose (max. 600 mg) in normal saline slowly over 1 to 2 hrs, followed by continuous infusion of 0.02 mg/kg/min until oral therapy can be started	Same as adult dose
	OR	Quinine dihydrochloride[65]	20 mg/kg loading dose IV in 5% dextrose over 4 hrs, followed by 10 mg/kg over 2-4 hrs q8h (max. 1800 mg/d) until oral therapy can be started	Same as adult dose
Alternative:		Artemether[66]*	3.2 mg/kg IM, then 1.6 mg/kg daily x 5-7d	Same as adult dose
Prevention of relapses: *P. vivax* and *P. ovale* only				
Drug of choice:		Primaquine phosphate[62,67]	26.3 mg (15 mg base)/d x 14d or 79 mg (45 mg base)/wk x 8 wks	0.3 mg base/kg/d x 14d
MALARIA, Prevention of[68]				
Chloroquine-sensitive areas[49]				
Drug of choice:		Chloroquine phosphate[69,70]	500 mg (300 mg base), once/week[71]	5 mg/kg base once/week, up to adult dose of 300 mg base[71]
Chloroquine-resistant areas[49]				
Drug of choice:		Mefloquine[56,70,72]	250 mg once/week[71]	<15 kg: 5 mg/kg[71] 15-19 kg: ¼ tablet[71] 20-30 kg: ½ tablet[71] 31-45 kg: ¾ tablet[71] >45 kg: 1 tablet[71]
	OR	Doxycycline[7, 70]	100 mg daily[73]	2 mg/kg/d, up to 100 mg/day[73]
	OR	Atovaquone/ Proguanil[53,70]	250 mg/100 mg (1 adult tablet) daily[74]	11-20 kg: 62.5 mg/25 mg[53,74] 21-30 kg: 125 mg/50 mg[53,74] 31-40 kg: 187.5 mg/75 mg[53,74] >40 kg: 250 mg/100 mg[53,74]
Alternatives:		Primaquine[7,62,75]	30 mg base daily	0.5 mg/kg base daily

* Availability problems. See table on page 12.

63. If chloroquine phosphate is not available, hydroxychloroquine sulfate is as effective; 400 mg of hydroxychloroquine sulfate is equivalent to 500 mg of chloroquine phosphate.
64. Exchange transfusion has been helpful for some patients with high-density (>10%) parasitemia, altered mental status, pulmonary edema or renal complications (KD Miller et al, N Engl J Med 1989; 321:65).
65. Continuous EKG, blood pressure and glucose monitoring are recommended, especially in pregnant women and young children. For problems with quinidine availability, call the manufacturer (Eli Lilly, 800-821-0538) or the CDC Malaria Hotline (770-488-7788). Quinidine may have greater antimalarial activity than quinine. The loading dose should be decreased or omitted in those patients who have received quinine or mefloquine. If more than 48 hours of parenteral treatment is required, the quinine or quinidine dose should be reduced by 1/3 to 1/2.
66. Artemether-Quinine Meta-Analysis Study Group, Trans R Soc Trop Med Hyg 2001; 95:637. Not available in the US.
67. Relapses have been reported with this regimen, and should be treated with a second 14-day course of 30 mg base/day. In Southeast Asia and Somalia the higher dose (30 mg base/day) should be used initially.
68. No drug regimen guarantees protection against malaria. If fever develops within a year (particularly within the first two months) after travel to malarious areas, travelers should be advised to seek medical attention. Insect repellents, insecticide-impregnated bed nets and proper clothing are important adjuncts for malaria prophylaxis.
69. In pregnancy, chloroquine prophylaxis has been used extensively and safely.
70. For prevention of attack after departure from areas where *P. vivax* and *P. ovale* are endemic, which includes almost all areas where malaria is found (except Haiti), some experts prescribe in addition primaquine phosphate 26.3 mg (15 mg base)/d or, for children, 0.3 mg base/kg/d during the last two weeks of prophylaxis. Others prefer to avoid the toxicity of primaquine and rely on surveillance to detect cases when they occur, particularly when exposure was limited or doubtful. See also footnotes 62 and 67.
71. Beginning one to two weeks before travel and continuing weekly for the duration of stay and for four weeks after leaving.
72. The pediatric dosage has not been approved by the FDA, and the drug has not been approved for use during pregnancy. However, it has been reported to be safe for prophylactic use during the second or third trimester of pregnancy and possibly during early pregnancy as well (CDC Health Information for International Travel, 2001-2002, page 113; BL Smoak et al, J Infect Dis 1997; 176:831). Mefloquine is not recommended for patients with cardiac conduction abnormalities. Patients with a history of seizures or psychiatric disorders should avoid mefloquine (Medical Letter 1990; 32:13). Resistance to mefloquine has been reported in some areas, such as Thailand; in these areas, doxycycline should be used for prophylaxis. In children less than eight years old, proguanil plus sulfisoxazole has been used (KN Suh and JS Keystone, Infect Dis Clin Pract 1996; 5:541).
73. Beginning 1-2 days before travel and continuing for the duration of stay and for 4 weeks after leaving. Use of tetracyclines is contraindicated in pregnancy and in children less than eight years old. Doxycycline can cause gastrointestinal disturbances, vaginal moniliasis and photosensitivity reactions.
74. GE Shanks et al, Clin Infect Dis 1998; 27:494; B Lell et al, Lancet 1998; 351:709. Beginning 1 to 2 days before travel and continuing for the duration of stay and for 1 week after leaving. In one study of malaria prophylaxis, atovaquone/proguanil was better tolerated than mefloquine in nonimmune travelers (D Overbosch et al, Clin Infect Dis 2001; 33:1015).
75. Several studies have shown that daily primaquine beginning one day before departure and continued until 7 days after leaving the malaria area provides effective prophylaxis against chloroquine-resistant *P. falciparum* (JK Baird et al, Clin Infect Dis 2001; 33:1990). Some studies have shown less efficacy against *P. vivax*. Nausea and abdominal pain can be diminished by taking with food.

Infection	Drug	Adult dosage	Pediatric dosage
MALARIA, Prevention of *(continued)*			
Chloroquine-resistant areas[49]			
Alternatives:	Chloroquine phosphate	500 mg (300 mg base) once/week[71]	5 mg/kg base once/week, up to adult dose of 300 mg base[71]
	plus proguanil[76]	200 mg once/day	<2 yrs: 50 mg once/day 2-6 yrs: 100 mg once/day 7-10 yrs: 150 mg once/day >10 yrs: 200 mg once/day
Presumptive treatment	Atovaquone/ proguanil[53]	2 adult tablets bid x 3d[74]	11-20 kg: one adult tablet/day x 3d[74] 21-30 kg: 2 adult tablets/day x 3d[74] 31-40 kg: 3 adult tablets/day x 3d[74] >40 kg: 2 adult tablets bid x 3d[74]
	OR Pyrimethamine-sulfadoxine[51]	Carry a single dose (3 tablets) for self treatment of febrile illness when medical care is not immediately available	<1 yr: ¼ tablet 1-3 yrs: ½ tablet 4-8 yrs: 1 tablet 9-14 yrs: 2 tablets
MICROSPORIDIOSIS			
Ocular (*Encephalitozoon hellem, Encephalitozoon cuniculi, Vittaforma corneae* [*Nosema corneum*])			
Drug of choice:	Albendazole[7] plus fumagillin[77*]	400 mg bid	
Intestinal (*Enterocytozoon bieneusi, Encephalitozoon [Septata] intestinalis*)			
E. bieneusi[78]			
Drug of choice:	Fumagillin*	60 mg/d PO x 14d	
E. intestinalis			
Drug of choice:	Albendazole[7]	400 mg bid x 21d	
Disseminated *(E. hellem, E. cuniculi, E. intestinalis, Pleistophora sp., Trachipleistophora sp.* and *Brachiola vesicularum)*			
Drug of choice:[79]	Albendazole[7]	400 mg bid	
Mites, see SCABIES			
MONILIFORMIS *moniliformis* infection			
Drug of choice:	Pyrantel pamoate[7]	11 mg/kg once, repeat twice, 2 wks apart	11 mg/kg once, repeat twice, 2 wks apart
***Naegleria* species**, see AMEBIC MENINGOENCEPHALITIS, PRIMARY			
Necator americanus, see HOOKWORM infection			
OESOPHAGOSTOMUM *bifurcum*			
Drug of choice:	See footnote 80		
Onchocerca volvulus, see FILARIASIS			
Opisthorchis viverrini, see FLUKE infection			
Paragonimus westermani, see FLUKE infection			
Pediculus capitis, humanus, Phthirus pubis, see LICE			
Pinworm, see ENTEROBIUS			

* Availability problems. See table on page 12.

76. Proguanil (*Paludrine* – Wyeth Ayerst, Canada; AstraZeneca, United Kingdom), which is not available alone in the US but is widely available in Canada and Europe, is recommended mainly for use in Africa south of the Sahara. Prophylaxis is recommended during exposure and for four weeks afterwards. Proguanil has been used in pregnancy without evidence of toxicity (PA Phillips-Howard and D Wood, Drug Saf 1996; 14:131).
77. Ocular lesions due to *E. hellem* in HIV-infected patients have responded to fumagillin eyedrops prepared from *Fumidil-B*, a commercial product (Mid-Continent Agrimarketing, Inc., Olathe, Kansas, 800-547-1392) used to control a microsporidial disease of honey bees (MC Diesenhouse, Am J Ophthalmol 1993; 115:293). For lesions due to *V. corneae*, topical therapy is generally not effective and keratoplasty may be required (RM Davis et al, Ophthalmology 1990; 97:953).
78. Oral fumagillin (see footnote 77, Sanofi Recherche, Gentilly, France) has been effective in treating *E. bieneusi* (J-M Molina et al, AIDS 2000; 14:1341), but has been associated with thrombocytopenia. Highly active antiretroviral therapy (HAART) may lead to microbiologic and clinical response in HIV-infected patients with microsporidial diarrhea (NA Foudraine et al, AIDS 1998; 12:35; A Carr et al, Lancet 1998; 351:256). Octreotide *(Sandostatin)* has provided symptomatic relief in some patients with large volume diarrhea.
79. J-M Molina et al, J Infect Dis 1995; 171:245. There is no established treatment for *Pleistophora*.
80. Albendazole or pyrantel pamoate may be effective (HP Krepel et al, Trans R Soc Trop Med Hyg 1993; 87:87).

Infection	Drug	Adult dosage	Pediatric dosage
***PNEUMOCYSTIS** carinii* pneumonia (PCP)[81]			
Drug of choice:	Trimethoprim-sulfamethoxazole	TMP 15 mg/kg/d, SMX 75 mg/kg/d, oral or IV in 3 or 4 doses x 14-21d	Same as adult dose
Alternatives:	Primaquine[7,62]	30 mg base PO daily x 21 days	
	plus clindamycin[7]	600 mg IV q6h x 21 days, or 300-450 mg PO q6h x 21 days	
OR	Trimethoprim[7]	5 mg/kg PO tid x 21 days	
	plus dapsone[7]	100 mg PO daily x 21 days	
	Pentamidine	3-4 mg/kg IV daily x 14-21 days	Same as adult dose
OR	Atovaquone	750 mg bid PO x 21d	
Primary and secondary prophylaxis[82]			
Drug of Choice:	Trimethoprim-sulfamethoxazole	1 tab (single or double strength) daily	TMP 150 mg/m^2, SMX 750 mg/m^2 in 2 doses on 3 consecutive days per week
Alternatives:[83]	Dapsone[7]	50 mg bid, or 100 mg daily	2 mg/kg (max. 100 mg) daily or 4 mg/kg (max. 200 mg each week)
OR	Dapsone[7]	50 mg daily or 200 mg each week	
	plus pyrimethamine[84]	50 mg or 75 mg each week	
OR	Pentamidine aerosol	300 mg inhaled monthly via *Respirgard II* nebulizer	≥5 yrs: same as adult dose
OR	Atovaquone[7]	1500 mg daily	
Roundworm, see ASCARIASIS			
Sappinia Diploidea, See AMEBIC MENINGOENCEPHALITIS, PRIMARY			
SCABIES *(Sarcoptes scabiei)*			
Drug of choice:	5% Permethrin	Topically	Topically
Alternatives:	Ivermectin[7,85]	200 μg/kg PO once	200 μg/kg PO once
	10% Crotamiton	Topically once/daily x 2	Topically once/daily x 2
SCHISTOSOMIASIS *(Bilharziasis)*			
S. haematobium			
Drug of choice:	Praziquantel	40 mg/kg/d in 2 doses x 1d	40 mg/kg/d in 2 doses x 1d
S. japonicum			
Drug of choice:	Praziquantel	60 mg/kg/d in 3 doses x 1d	60 mg/kg/d in 3 doses x 1d
S. mansoni			
Drug of choice:	Praziquantel	40 mg/kg/d in 2 doses x 1d	40 mg/kg/d in 2 doses x 1d
Alternative:	Oxamniquine[86]	15 mg/kg once[87]	20 mg/kg/d in 2 doses x 1d[87]
S. mekongi			
Drug of choice:	Praziquantel	60 mg/kg/d in 3 doses x 1d	60 mg/kg/d in 3 doses x 1d
Sleeping sickness, see TRYPANOSOMIASIS			
STRONGYLOIDIASIS *(Strongyloides stercoralis)*			
Drug of choice:[88]	Ivermectin	200 μg/kg/d x 1-2d	200 μg/kg/d x 1-2d
Alternative:	Thiabendazole	50 mg/kg/d in 2 doses (max. 3 grams/d) x 2d[89]	50 mg/kg/d in 2 doses (max. 3 grams/d) x 2d[89]

* Availability problems. See table on page 12.

81. In severe disease with room air $PO_2 \leq 70$ mmHg or Aa gradient ≥ 35 mmHg, prednisone should also be used (S Gagnon et al, N Engl J Med 1990; 323:1444; E Caumes et al, Clin Infect Dis 1994; 18:319).
82. Primary/secondary prophylaxis in patients with HIV can be discontinued after CD4 count increases to >200 x 10^6/L for more than 3 months (HIV/AIDS Treatment Information Service, US Department of Health and Human Services 2001; www.hivatis.org).
83. An alternative trimethoprim/sulfamethoxazole regimen is one DS tab 3x/week. Weekly therapy with sulfadoxine 500 mg/pyrimethamine 25 mg/leucovorin 25 mg was effective PCP prophylaxis in liver transplant patients (J Torre-Cisneros et al, Clin Infect Dis 1999; 29:771).
84. Plus leucovorin 25 mg with each dose of pyrimethamine.
85. Effective for crusted scabies in immunocompromised patients (M Larralde et al, Pediatr Dermatol 1999; 16:69; A Patel et al, Australas J Dermatol 1999; 40:37; O Chosidow, Lancet 2000; 355:819).
86. Oxamniquine has been effective in some areas in which praziquantel is less effective (FF Stelma et al, J Infect Dis 1997; 176:304). Oxamniquine is contraindicated in pregnancy.
87. In East Africa, the dose should be increased to 30 mg/kg, and in Egypt and South Africa to 30 mg/kg/d x 2d. Some experts recommend 40-60 mg/kg over 2-3 days in all of Africa (KC Shekhar, Drugs 1991; 42:379).
88. In immunocompromised patients or disseminated disease, it may be necessary to prolong or repeat therapy or use other agents. A veterinary parenteral formulation of ivermectin was used in one patient (PL Chiodini et al, Lancet 2000; 355:43).
89. This dose is likely to be toxic and may have to be decreased.

Infection	Drug	Adult dosage	Pediatric dosage
TAPEWORM infection			
— **Adult (intestinal stage)**			
***Diphyllobothrium latum* (fish), *Taenia saginata* (beef), *Taenia solium* (pork), *Dipylidium caninum* (dog)**			
Drug of choice:	Praziquantel[7]	5-10 mg/kg once	5-10 mg/kg once
Alternative:	Niclosamide	2 g once	50 mg/kg once
***Hymenolepis nana* (dwarf tapeworm)**			
Drug of choice:	Praziquantel[7]	25 mg/kg once	25 mg/kg once
— **Larval (tissue stage)**			
***Echinococcus granulosus* (hydatid cyst)**			
Drug of choice:[90]	Albendazole	400 mg bid x 1-6 months	15 mg/kg/d (max. 800 mg) x 1-6 months
Echinococcus multilocularis			
Treatment of choice:	See footnote 91		
***Cysticercus cellulosae* (cysticercosis)**			
Treatment of choice:	See footnote 92		
Alternative:	Albendazole	400 mg bid x 8-30d; can be repeated as necessary	15 mg/kg/d (max. 800 mg) in 2 doses x 8-30d; can be repeated as necessary
OR	Praziquantel[7]	50-100 mg/kg/d in 3 doses x 30d	50-100 mg/kg/d in 3 doses x 30d
Toxocariasis, see VISCERAL LARVA MIGRANS			
TOXOPLASMOSIS *(Toxoplasma gondii)*[93]			
Drugs of choice:[94]	Pyrimethamine[95]	25-100 mg/d x 3-4 wks	2 mg/kg/d x 3d, (max. 25 mg/d) x 4 wks[96]
	plus		
	sulfadiazine	1-1.5 grams qid x 3-4 wks	100-200 mg/kg/d x 3-4 wks
Alternative:[97]	Spiramycin*	3-4 grams/d x 3-4 wks	50-100 mg/kg/d x 3-4 wks
TRICHINOSIS *(Trichinella spiralis)*			
Drugs of choice:	Steroids for severe symptoms		
	plus		
	mebendazole[7]	200-400 mg tid x 3d, then 400-500 mg tid x 10d	200-400 mg tid x 3d, then 400-500 mg tid x 10d
Alternative:	Albendazole[7]	400 mg bid x 8-14d	400 mg bid x 8-14d
TRICHOMONIASIS *(Trichomonas vaginalis)*			
Drug of choice:[98]	Metronidazole	2 grams once or 500 mg bid x 7d	15 mg/kg/d orally in 3 doses x 7d
OR	Tinidazole[5]	2 grams once or 500 mg bid	50 mg/kg once (max. 2 g)

* Availability problems. See table on page 12.

90. Patients may benefit from or require surgical resection of cysts. Praziquantel is useful preoperatively or in case of spill during surgery. Percutaneous drainage with ultrasound guidance plus albendazole therapy has been effective for management of hepatic hydatid cyst disease (MS Khuroo et al, N Engl J Med 1997; 337:881; O Akhan and M Ozman, Eur J Radiol 1999; 32:76).
91. Surgical excision or the PAIR (Puncture, Aspirate, Inject, Re-aspirate) technique is the only reliable means of cure. Reports have suggested that in non-resectable cases use of albendazole or mebendazole can stabilize and sometimes cure infection (W Hao et al, Trans R Soc Trop Med Hyg 1994; 88:340; WHO Group, Bull WHO 1996; 74:231).
92. Initial therapy of parenchymal disease with seizures should focus on symptomatic treatment with anticonvulsant drugs. Treatment of parenchymal disease with albendazole and praziquantel is controversial and randomized trials have not been conclusive. Obstructive hydrocephalus is treated with surgical removal of the obstructing cyst or CSF diversion. Prednisone 40 mg daily may be given in conjunction with surgery. Arachnoiditis, vasculitis or cerebral edema is treated with prednisone 60 mg daily or dexamethasone 4-16 mg/d combined with albendazole or praziquantel (AC White, Jr, Annu Rev Med 2000; 51:187). Patients with subarachnoid cysts or giant cysts in the fissures should receive albendazole for at least 30 days (JV Proano et al, N Engl J Med 2001; 345:879). Any cysticercocidal drug may cause irreparable damage when used to treat ocular or spinal cysts, even when corticosteroids are used. An ophthalmic exam should always be done before treatment to rule out intraocular cysts.
93. In ocular toxoplasmosis with macular involvement, corticosteroids are recommended for an anti-inflammatory effect on the eyes.
94. To treat CNS toxoplasmosis in HIV-infected patients, some clinicians have used pyrimethamine 50 to 100 mg daily (after a loading dose of 200 mg) with sulfadiazine and, when sulfonamide sensitivity developed, have given clindamycin 1.8 to 2.4 g/d in divided doses instead of the sulfonamide (JS Remington et al, Lancet 1991; 338:1142; BJ Luft et al, N Engl J Med 1993; 329:995). Atovaquone plus pyrimethamine appears to be an effective alternative in sulfa-intolerant patients (JA Kovacs et al, Lancet 1992; 340:637). Treatment is followed by chronic suppression with lower dosage regimens of the same drugs. For primary prophylaxis in HIV patients with <100 CD4 cells, either trimethoprim-sulfamethoxazole, pyrimethamine with dapsone or atovaquone with or without pyrimethamine can be used. Primary/Secondary prophylaxis may be discontinued when the CD4 count increases to >200 x 10^6/L for more than 3 months (HIV/AIDS Treatment Information Service US Department of Health and Human Services 2001; (www.hivatis.org). See also footnote 95.
95. Plus leucovorin 10 to 25 mg with each dose of pyrimethamine.
96. Congenitally infected newborns should be treated with pyrimethamine every two or three days and a sulfonamide daily for about one year (JS Remington and G Desmonts in JS Remington and JO Klein, eds, *Infectious Disease of the Fetus and Newborn Infant*, 5th ed, Philadelphia:Saunders, 2001, page 290).
97. For prophylactic use during pregnancy. If it is determined that transmission has occurred *in utero*, therapy with pyrimethamine and sulfadiazine should be started. Pyrimethamine is a potential teratogen and should be used only after the first trimester.
98. Sexual partners should be treated simultaneously. Metronidazole-resistant strains have been reported and should be treated with metronidazole 2-4 g/d x 7-14d. Desensitization has been recommended for patients allergic to metronidazole (MD Pearlman et al, Am J Obstet Gynecol 1996; 174:934). High dose tinidazole has also been used for the treatment of metronidazole-resistant trichomoniasis (JD Sobel et al, Clin Infect Dis 2001; 33:1341).

Infection	Drug	Adult dosage	Pediatric dosage
TRICHOSTRONGYLUS infection			
Drug of choice:	Pyrantel pamoate[7]	11 mg/kg base once (max. 1 g)	11 mg/kg once (max. 1 gram)
Alternative:	Mebendazole[7]	100 mg bid x 3d	100 mg bid x 3d
OR	Albendazole[7]	400 mg once	400 mg once
TRICHURIASIS (*Trichuris trichiura*, whipworm)			
Drug of choice:	Mebendazole	100 mg bid x 3d or 500 mg once	100 mg bid x 3d or 500 mg once
Alternative:	Albendazole[7]	400 mg x 3d	400 mg x 3d
TRYPANOSOMIASIS			
***T. cruzi* (American trypanosomiasis, Chagas' disease)**			
Drug of choice:	Benznidazole*	5-7 mg/kg/d in 2 divided doses x 30-90d	Up to 12 yrs: 10 mg/kg/d in 2 doses x 30-90d
OR	Nifurtimox[99]*	8-10 mg/kg/d in 3-4 doses x 90-120d	1-10 yrs: 15-20 mg/kg/d in 4 doses x 90d; 11-16 yrs: 12.5-15 mg/kg/d in 4 doses x 90d
***T. brucei gambiense* (West African trypanosomiasis, sleeping sickness) hemolymphatic stage**			
Drug of choice:[100]	Pentamidine isethionate[7]	4 mg/kg/d IM x 10d	4 mg/kg/d IM x 10d
Alternative:	Suramin*	100-200 mg (test dose) IV, then 1 gram IV on days 1,3,7,14, and 21	20 mg/kg on days 1,3,7,14, and 21
OR	Eflornithine*	See footnote 101	
***T. b. rhodesiense* (East African trypanosomiasis, sleeping sickness) hemolymphatic stage**			
Drug of choice:	Suramin*	100-200 mg (test dose) IV, then 1 gram IV on days 1,3,7,14, and 21	20 mg/kg on days 1,3,7,14, and 21
late disease with CNS involvement *(T.b. gambiense or T.b. rhodesiense)*			
Drug of choice:	Melarsoprol[102]*	2-3.6 mg/kg/d IV x 3d; after 1 wk 3.6 mg/kg per day IV x 3d; repeat again after 10-21 days	18-25 mg/kg total over 1 month; initial dose of 0.36 mg/kg IV, increasing gradually to max. 3.6 mg/kg at intervals of 1-5d for total of 9-10 doses
OR	Eflornithine	See footnote 101	
VISCERAL LARVA MIGRANS[103] (Toxocariasis)			
Drug of choice:	Albendazole[7]	400 mg bid x 5d	400 mg bid x 5d
	Mebendazole[7]	100-200 mg bid x 5d	100-200 mg bid x 5d
Whipworm, see TRICHURIASIS			
Wuchereria bancrofti, see FILARIASIS			

* Availability problems. See table on page 12.

99. Available from CDC. The addition of gamma interferon to nifurtimox for 20 days in a limited number of patients and in experimental animals appears to have shortened the acute phase of Chagas' disease (RE McCabe et al, J Infect Dis 1991; 163:912).
100. For treatment of *T.b. gambiense,* pentamidine and suramin have equal efficacy but pentamidine is better tolerated.
101. Eflornithine is highly effective in *T.b. gambiense* and variably effective in *T.b. rhodesiense* infections. It is available in limited supply only from the WHO, and is given 400 mg/kg/d IV in 4 divided doses for 14 days.
102. In frail patients, begin with as little as 18 mg and increase the dose progressively. Pretreatment with suramin has been advocated for debilitated patients. Corticosteroids have been used to prevent arsenical encephalopathy (J Pepin et al, Trans R Soc Trop Med Hyg 1995; 89:92). Up to 20% of patients with *T. gambiense* fail to respond to melarsoprol (MP Barrett, Lancet 1999; 353:1113). A shortened course consisting of 10 daily injections of 2.2 mg/kg gave a similar outcome to the usual 26-treatment schedule (C Burri et al, Lancet 2000; 355:1419).
103. Optimum duration of therapy is not known; some Medical Letter consultants would treat for up to 20 days. For severe symptoms or eye involvement, corticosteroids can be used in addition.

MANUFACTURERS OF SOME ANTIPARASITIC DRUGS

albendazole – *Albenza* (GlaxoSmithKline)
§ artemether – *Artenam* (Arenco, Belgium)
§ artesunate – (Guilin No. 1 Factory, People's Republic of China)
atovaquone – *Mepron* (GlaxoSmithKline)
atovaquone/proguanil — *Malarone* (GlaxoSmithKline)
bacitracin – many manufacturers
§ bacitracin-zinc – (Apothekernes Laboratorium A.S., Oslo, Norway)
§ benznidazole – *Rochagan* (Roche, Brazil)
† bithionol – *Bitin* (Tanabe, Japan)
chloroquine HCl and chloroquine phosphate – *Aralen* (Sanofi), others
crotamiton – *Eurax* (Westwood-Squibb)
dapsone – (Jacobus)
† diethylcarbamazine citrate USP – (University of Iowa School of Pharmacy)
§ diloxanide furoate – *Furamide* (Boots, United Kingdom)
§ eflornithine (Difluoromethylornithine, DFMO) – *Ornidyl* (Aventis)
furazolidone – *Furoxone* (Roberts)
§ halofantrine – *Halfan* (GlaxoSmithKline)
iodoquinol – *Yodoxin* (Glenwood), others
ivermectin – *Stromectol* (Merck)
malathion – *Ovide* (Medicis)
mebendazole – *Vermox* (McNeil)
mefloquine – *Lariam* (Roche)
§ meglumine antimonate – *Glucantime* (Aventis, France)
† melarsoprol – *Mel-B* (Specia)
metronidazole – *Flagyl* (Searle), others
§ miltefosine – (Zentaris)
§ niclosamide – *Yomesan* (Bayer, Germany)
† nifurtimox – *Lampit* (Bayer, Germany)
* nitazoxanide – *Cryptaz* (Romark)
§ ornidazole – *Tiberal* (Roche, France)
oxamniquine – *Vansil* (Pfizer)
paromomycin – *Humatin* (Monarch); *Leshcutan* (Teva Pharmaceutical Industries, Ltd., Israel; (topical formulation not available in US)
pentamidine isethionate – *Pentam 300, NebuPent* (Fujisawa)
permethrin – *Nix* (GlaxoSmithKline), *Elimite* (Allergan)
praziquantel – *Biltricide* (Bayer)
primaquine phosphate USP
§ proguanil – *Paludrine* (Wyeth Ayerst, Canada; AstraZeneca, United Kingdom); in combination with atovaquone as *Malarone* (GlaxoSmithKline)
§ propamidine isethionate – *Brolene* (Aventis, Canada)
pyrantel pamoate – *Antiminth* (Pfizer)
pyrethrins and piperonyl butoxide – *RID* (Pfizer), others
pyrimethamine USP – *Daraprim* (GlaxoSmithKline)
§ quinine dihydrochloride
quinine sulfate – many manufacturers
† sodium stibogluconate – *Pentostam* (GlaxoSmithKline, United Kingdom)
* spiramycin – *Rovamycine* (Aventis)
† suramin sodium – (Bayer, Germany)
thiabendazole – *Mintezol* (Merck)
§ tinidazole – *Fasigyn* (Pfizer)
* triclabendazole – *Egaten* (Novartis, Switzerland)
trimetrexate – *Neutrexin* (US Bioscience)

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* Available in the US only from the manufacturer.
§ Not available in the US.
† Available under an Investigational New Drug (IND) protocol from the CDC Drug Service, Centers for Disease Control and Prevention, Atlanta, Georgia 30333; 404-639-3670 (evenings, weekends, or holidays: 404-639-2888).

THE MEDICAL LETTER® (ISSN 1523-2859) is published and printed in the USA bi-weekly by The Medical Letter, Inc., a nonprofit corporation. Nonprofit standard postage paid at New Rochelle, NY, and at additional mailing offices. POSTMASTER: Send address changes to THE MEDICAL LETTER at 1000 Main Street, New Rochelle, NY 10801-7537. Subscription fees: 1 year, $55.00; 2 years, $94.00; 3 years, $132.00 ($27.50—U.S. Funds—per year for individual subscriptions to students, interns, residents, and fellows in the USA and Canada; special fees for bulk orders). Major credit cards accepted.
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