

Chapter 23

Antiparasitic Agents

AMPHOTERICIN B: in WHO Model List of Essential Drugs

Indications: amoebic meningoencephalitis, visceral leishmaniasis

Side Effects: see Chapter 22

MICONAZOLE

Indications: amoebic meningoencephalitis

Side Effects: see Chapter 22

RIFAMPICIN

Indications: amoebic meningoencephalitis

Side Effects: see Chapter 21

CLOTRIMAZOLE

Indications: keratitis and iritis due to *Acanthamoeba* (topical); *Trichomonas vaginalis* infections (topical)

Side Effects: see Chapter 22

DIBROMOPROPAMIDINE ISETHIONATE

Indications: keratitis and iritis due to *Acanthamoeba* (topical)

GENTAMICIN

Indications: keratitis and iritis due to *Acanthamoeba* (topical)

NEOMYCIN

Indications: keratitis and iritis due to *Acanthamoeba* (topical)

Side Effects: sensitisation

PROPAMIDINE ISETHIONATE

Indications: keratitis and iritis due to *Acanthamoeba* (topical)

DEHYDROEMETINE

Indications: extraintestinal and symptomatic intestinal amoebiasis

DILOXANIDE FUROATE: luminal amoebicide; in WHO Model List of Essential Drugs; oral (take with or after food); available in US only from CDC; not available in Australia; poor GI absorption

Indications: infections with amoebae including *Entamoeba histolytica* (elimination of carrier state)

Side Effects: flatulence; diplopia (rare); dose adjustment not required in renal failure or in dialysis; safety in pregnancy or breastfeeding not established

EMETINE

Indications: symptomatic intestinal amoebiasis (effective for both luminal and invasive infections); hepatitis and hepatic abscess due to *Entamoeba histolytica* if no response to metronidazole in 72 h (prolonged treatment may be recommended)

Side Effects: unsafe because of drug accumulation and side effects, including cardiotoxicity and death

IODOQUINOL (DIODOHYDROXYQUINE): hydroxyquinolone; treatment course 20 d; effective and inexpensive

Indications: infections with amoebae including *Entamoeba histolytica* (elimination of carrier state); has not been shown to be effective for routine treatment of diarrhoea

Side Effects: associated with severe neurological disorders, optic neuritis and atrophy with extended use (rare)

METRONIDAZOLE: nitroimidazole; take with or after food (benzylmetronidazole: ½ - 1 h before food); in WHO Model List of Essential Drugs; spectrum includes amoebae (*Entamoeba histolytica*, *Giardia intestinalis*, *Trichomonas vaginalis*)

Indications: amoebiasis (cyst passers, extraintestinal (brain abscess, cutaneous, hepatic abscess), symptomatic intestinal; treatment of choice for invasive); biliary cirrhosis due to flukes; chronic diarrhoea; enteritis due to *Balantidium coli*, *Blastocystis hominis*, protozoans other than *Cryptosporidium*, *Isospora belli* and microsporidia;

dracunculiasis; giardiasis; isolated skin lesions due to *Leishmania braziliensis*, *Leishmania mexicana*; trichomoniasis; Indian visceral leishmaniasis; trichomonal vulvovaginitis

Side Effects: see Chapter 21

TINIDAZOLE: nitroimidazole; take with or after food; as effective as metronidazole and better tolerated; not available in US

Indications: intestinal amoebiasis; enteritis due to protozoans other than *Cryptosporidium*, *Isospora belli* and microsporidia; giardiasis; hepatic abscess due to *Entamoeba histolytica*; persistent traveller's diarrhoea; trichomonal vaginitis

Side Effects: see Chapter 21

ORMIDAZOLE: as for **TINIDAZOLE**

PAROMOMYCIN: aminoglycoside; treatment course 7 d

Indications: intestinal amoebiasis; enteritis due to *Balantidium coli*, *Diphyllobothrium*, *Hymenolepis*, *Taenia*; isolated skin lesions due to *Leishmania tropica*; giardiasis; not registered for use in Australia

Side Effects: gastrointestinal disturbances, nephrotoxicity and ototoxicity (rare); may be used during pregnancy

CHLOROQUINE: rapidly acting blood schizonticide; effective against *Plasmodium malariae*, *Plasmodium ovale* and *Plasmodium vivax* but widespread resistance of *Plasmodium falciparum*; phosphate (preferred form) and sulphate oral preparations (take with or after food), hydrochloride for i.v. and i.m. use; in WHO Model List of Essential Drugs as main list drug for curative treatment and prophylaxis of malaria and as complementary drug in amoebiasis (liver abscess only, not effective against luminal parasites) when drugs in the main list are known to be ineffective or inappropriate for a given individual; half life 120 h; high GI absorption

Indications: amoebic liver abscess if no response to metronidazole in 72 h; babesiosis; cholangitis and cholecystitis due to *Clonorchis sinensis*, *Opisthorchis*; infections with *Leishmania*; treatment and prophylaxis of malaria

Side Effects: headache, gastrointestinal upset (nausea, vomiting, diarrhoea; can be minimised by administering with meals), pruritis, lichenoid skin eruptions common; anxiety, personality changes, psychosis, reversible corneal deposits (minute subepithelial spots or cat's whiskers radiation) and retinopathy (membranous or myeloid bodies in ganglion cells) on prolonged administration (> 100 g; particularly fair-skinned, blue-eyed people), blurring of vision due to problems of visual accommodation in long term use uncommon; myopathy, worsening of psoriasis, tinnitus, ototoxicity (hearing loss) with long term use, photosensitivity, TSH elevation, exacerbation of symptoms of porphyria, provocation of seizures in people with epilepsy, alopecia, bleaching of hair, mucous membrane pigmentation, irreversible renal injury rare; overdose ? cardiovascular collapse and death (particularly with i.v. and i.m.); must never be given by i.v. bolus injection; dose adjustment required in severe renal failure (glomerular filtration rate < 10 mL/min), not in dialysis except in continuous venovenous or arteriovenous haemodialysis; weekly dosing safe in pregnancy; absorption moderately reduced by antacids; increases plasma levels of chlorpromazine (increased risk of QT interval prolongation), cyclosporin (possible nephrotoxicity), digoxin, penicillamine; theoretical increased risk of convulsions with mefloquine; reduces bioavailability of methotrexate; decreases plasma levels of praziquantel; increases incidence of mouth ulcers with proguanil

Contraindications: renal/hepatic insufficiency, severe blood or gastrointestinal disease, concomitant use of phenylbutazone, pregnancy (treatment, but regularly used in treatment of malaria; safe in prophylaxis), porphyria, epilepsy

TETRACYCLINE: oral (take ½ - 1 h before food); half life 9 h

Indications: symptomatic intestinal amoebiasis (Nnt effective against liver abscess; may have limited activity for invasive intestinal disease); *Balantidium coli* enteritis; treatment of chloroquine resistant malaria

Side Effects: see Chapter 221

Contraindications: pregnancy, children ? 8 y

FURAZOLIDONE: nitrofurantoin

Indications: treatment of enteritis due to *Blastocystis hominis*, protozoans (including *Giardia intestinalis*) other than *Cryptosporidium*, *Isospora belli* and microsporidia

CRYSTAL VIOLET

Indications: trichomonal vaginitis (topical)

NATAMYCIN (PIMAFUCIN)**Indications:** trichomonal vaginitis (topical)**NIMORAZOLE****Indications:** trichomonal vaginitis**Contraindications:** pregnancy, lactation**QUINACRINE****Indications:** enteritis due to protozoans other than *Cryptosporidium*, *Isospora belli*, microsporidia**Side Effects:** yellow pigmentation of tissues, gastrointestinal disturbances, headache, uncommon allergic skin reaction, corneal oedema, blood dyscrasias, toxic psychoses; increases toxicity of primaquine; ? disulfiram-like intolerance of alcohol**NITAZOXANIDE:** not registered for use in Australia**Indications:** cryptosporidiosis**Side Effects:** most commonly, gastrointestinal**FUMAGILLIN:** not registered for use in Australia**Indications:** microsporidial infections**Side Effects:** thrombocytopenia, resolving on cessation of therapy, in immunocompromised patients**AMODIAQUINE****Indications:** infections with *Leishmania*, *Plasmodium***Side Effects:** gastrointestinal disturbances, tiredness, vertigo, pigmentation of palate, nail beds and skin, uncommonly agranulocytosis, liver damage**HYDROXYCHLOROQUINE:** oral (take with or after food)**Indications:** infections with *Leishmania*; malarial prophylaxis**MEPACRINE****Indications:** infections with *Leishmania*, *Plasmodium*, protozoans, tapeworms**PRIMAQUINE:** tissue schizonticide; in WHO Model List of Essential Drugs for curative treatment of malaria; oral (take with or after food)**Indications:** infections with *Leishmania*, *Pneumocystis jiroveci*; prevention of delayed attacks of *Plasmodium ovale* and *Plasmodium vivax* by eradication of liver cycle; prevention of transmission of falciparum malaria**Side Effects:** abdominal cramps and pain, epigastric distress, nausea and vomiting on an empty stomach common; haemolytic anaemia with large doses and in those with glucose-6-phosphate dehydrogenase deficiency, methaemoglobinemia and cyanosis uncommon; cardiac arrhythmias, hypertension, anaemia, leucopenia, agranulocytosis, fever, rash rare; risk of toxicity increased by quinacrine; increases plasma levels and adverse effects of mefloquine**Contraindications:** pregnancy, glucose-6-phosphate dehydrogenase deficiency (including breastfed infants; monitor also for haemolysis and jaundice in breastfed premature infants and those < 1 mo)**TAFENOQUINE:** primaquine derivative**Indications:** possibly more effective than primaquine in preventing relapse of *Plasmodium vivax* malaria**PROGUANIL (BIGUANIL, CHLOROQUANIDE):** antifolate drug; in WHO Model List of Essential Drugs for malarial prophylaxis (usually in combination with chloroquine; increasing resistance); take with or after food (absorption enhanced)**Indications:** infections with *Leishmania*; malarial prophylaxis where chloroquine cannot be administered**Side Effects:** generally mild and self-limiting; mild gastric intolerance (vomiting, abdominal pain, diarrhoea with large doses only), aphthous ulcers (increased incidence with chloroquine), stomatitis common; scaling of skin, alopecia, vertigo uncommon; red cells and casts in urine with excessive amounts; marrow suppression, allergic reactions, convulsions, psychosis, disseminated intravascular coagulation, hepatitis, megaloblastic anaemia rare; likely enhanced warfarin effect (frequent monitoring of prothrombin time essential); fluvoxamine decreases plasma levels and effect of active metabolite; absorption reduced by magnesium trisilicate; safety in pregnancy not established; safe in breastfeeding**PYRIMETHAMINE:** selectively inhibits dihydrofolate reductase; half life 96 h; oral (take with or after food); in WHO Model List of Essential Drugs**Indications:** infections with *Leishmania*, *Plasmodium*, *Toxoplasma gondii* (combined with another agent)

Side Effects: anorexia, vomiting, folic acid reversible megaloblastic anaemia, usually reversible leucopenia and other haematological toxicity with long term use, may be embryopathic; additional suppression of folate metabolism with cotrimoxazole, sulphonamides, trimethoprim and other folate antagonists (including cytostatic drugs) may result in serious pancytopenia and megaloblastic anaemia, rarely aplasia; convulsions in children with CNS leukemia treated with methotrexate; dose adjustment not required in renal failure or in dialysis but monitor for myelosuppression; safety in pregnancy not established; safe in breastfeeding

PYRIMETHAMINE-DAPSONE: interferes with folate metabolism; dapsone half life 21 hours

Indications: previously used for malaria prophylaxis

Side Effects: agranulocytosis, cyanosis, allergic dermatitis, gastrointestinal disorders, acute haemolysis in individuals with glucose-6-phosphate dehydrogenase deficiency; safety in pregnancy not established

Contraindications: avoid if breastfeeding G6PD deficient infants; monitor for haemolysis and jaundice if breastfeeding premature infant or < 1 mo old; avoid high doses if breastfeeding any infant (may interfere with folic acid metabolism)

PYRIMETHAMINE-SULPHADOXINE: interferes with folate metabolism; in WHO Model List of Essential Drugs as complementary drug for curative treatment of malaria when drugs in main list are known to be ineffective or inappropriate for a given individual; half life sulphadoxine 200 h; take with or after food

Indications: treatment of chloroquine resistant *Plasmodium falciparum* malaria (resistance increasing); maintenance therapy for *Isospora belli* enteritis

Side Effects: erythema multiforme, orogenital lesions, pharyngitis, pruritis, rash, agranulocytosis, exfoliative dermatitis, serum reaction type reaction, urticaria, gastrointestinal disturbances, induction of folate deficiency; Stevens-Johnson syndrome (can be fatal), toxic epidermal necrolysis rare; much more common when taken in combination with chloroquine

Contraindications: pregnancy; neonatal period; avoid if breastfeeding premature infant or infant < 1 mo or with G6PD deficiency

PYRIMETHAMINE-SULPHALENE

Indications: malaria prophylaxis

QUININE: rapidly acting blood schizonticide; in WHO Model List of Essential Drugs for curative treatment of malaria; oral (take with or after food) and parenteral; half life 10 h

Indications: babesiosis; infections with *Leishmania*; chloroquine-resistant severe falciparum malaria

Side Effects: tinnitus and auditory ototoxicity, headache, gastrointestinal disturbances (nausea, abdominal pain), photosensitivity, visual disturbance and impairment, urticaria, rashes, generalised cutaneous erythema and pruritis, confusion (idiosyncrasy or excessive dosage), fever, dyspnoea, hypoglycaemia, thrombocytopenia common; severe intravascular haemolysis in patients with G6PD deficiency; allergy, hyperinsulinemia, acute renal failure, angioedema rare; toxicity increased by pyrimethamine; must never be given by i.v. bolus injection; dose interval adjustment required in renal failure and in dialysis; unpredictably increases effect of oral anticoagulants; increased risk of QT prolongation with all drugs prolonging QT interval; may increase plasma levels of mefloquine, with theoretical increased risk of convulsions

Contraindications: pregnancy, haemolysis, tinnitus, optic neuritis; avoid if breastfeeding G6PD infant; monitor breastfed premature infant or infant < 1 mo for haemolysis and jaundice

QUINIDINE GLUCONATE

Indications: chloroquine-resistant severe malaria if quinine dihydrochloride unavailable

Side Effects: hyperinsulinemia, hypoglycaemia, cardiotoxicity (serious ventricular arrhythmia); never give by i.v. bolus injection

MEFLOQUINE: blood schizonticide; in WHO Model List of Essential Drugs in main list for prophylaxis of malaria and as complementary drug for curative treatment of malaria when drugs in main list are known to be ineffective or inappropriate for a given individual; oral (take with or after food); half life 21 d

Indications: curative treatment of malaria due to chloroquine resistant *Plasmodium falciparum*; malarial prophylaxis in areas with chloroquine resistant *Plasmodium falciparum*; use at present highly restricted in order to minimise development of resistance (increasing in Thailand, Cambodia and Myanmar)

Side Effects: nausea in 4%, depression, lethargy, bad dreams in 2%, vertigo in 2%, vomiting, diarrhoea, fever in 1%, tachycardia in 0.7%, euphoria in 0.7%; dyspepsia, dizziness, loss of balance, headache, insomnia, mental clouding, difficulty in performing skilled tasks also common; myalgia, rash, paraesthesia, visual disturbances, elevated transaminases, seizure, chest pain, oedema uncommon; severe neuropsychiatric adverse events in 0.01-0.5%; erythema multiforme, blood dyscrasias, hyperpyrexia rare; increased risk of convulsions with chloroquine, quinine, quinidine; ECG abnormalities reported with β -blockers, quinidine; increased risk of bradycardia with beta-blockers, calcium channel blockers, digoxin; significant cardiotoxic reactions in patients treated with halofantrine after taking mefloquine for prophylaxis; primaquine and quinine increase plasma levels; safety in pregnancy not established; caution in breastfeeding (monitor infant for adverse effects); dose modification not required in renal failure or in dialysis

Contraindications: children < 8 kg, patients with known hypersensitivity to mefloquine or related compounds (quinine, quinidine), neuropsychiatric disorders, epilepsy or cardiac conduction abnormalities or on drugs altering cardiac conduction

ITRACYCLINE

Indications: curative treatment of malaria

DOXYCYCLINE: blood schizonticide; in WHO Model List of Essential Drugs

Indications: treatment of chloroquine resistant malaria; malarial prophylaxis where chloroquine cannot be administered or in high risk individuals in areas with chloroquine resistant *Plasmodium falciparum*

Side Effects: see Chapter 21

Contraindications: pregnancy, children ? 8 y

QUINGHAOM (ARTEMETHER, ARTEMISATE, ARTEMISININ): artemether in WHO Model List of Essential Drugs

Indications: treatment of chloroquine resistant malaria

Contraindications: pregnancy (first trimester), avoid in breastfeeding (insufficient data)

ARTEMETHER + LUMEFANTRINE: oral; bioavailability increased when taken with fatty food

Indications: treatment of acute uncomplicated malaria due to *Plasmodium falciparum* in individuals ? 12 y and 35 kg; no significant effects on cardiac conduction and no interaction with mefloquine; oral (take with or after food)

Side Effects: headache, dizziness, sleep disorders, palpitations, anorexia, abdominal pain, nausea, vomiting, dyspepsia, diarrhoea, myalgias, arthralgia, fever, asthenia, fatigue, rigours, pruritis common

Contraindications: pregnancy (first trimester), avoid in breastfeeding (insufficient data)

ARTESUNATE: artemisin derivative

Indications: mefloquine resistant malaria, severe malaria (i.v.)

Side Effects: safety in pregnancy and breastfeeding not known (do not withhold in severe malaria)

HALOFANTRINE

Indications: treatment of chloroquine resistant malaria; postexposure malarial prophylaxis for high risk individuals in areas with chloroquine resistant *Plasmodium falciparum*

Side Effects: potentially fatal cardiotoxicity (potentiated by mefloquine and macrolides)

Contraindications: pregnancy

CORTICOSTEROIDS

Indications: hyperreactive malarial splenomegaly; *Toxoplasma* anterior uveitis and retinochoroiditis; severe visceral larva migrans

SODIUM STIBOGLUCONATE: solution must be protected from light

Indications: leishmaniasis; schistosomal enteritis, hepatitis, hepatic granuloma and urinary infection

Side Effects: arthralgia, blood dyscrasias, cardiotoxicity (ECG change, T wave depression, prolongation of QT interval, fusion of ST segment and T waves), hepatitis, myalgia, pneumonitis, pancreatitis (especially renal transplant recipients)

MEGLUMINE ANTIMONATE: in WHO Model List of Essential Drugs

Indications: leishmaniasis (92% cure rate in cutaneous, 66% in visceral), schistosomiasis

Side Effects: chemical pancreatitis in 30%, cardiotoxicity in 14%

PENTAMIDINE ISETHIONATE: in WHO Model List of Essential Drugs as main list drug to improve compliance

Indications: babesiosis; leishmaniasis (95% cure rate in cutaneous); treatment and prophylaxis of haemolympathic trypanosomiasis due to *Typanosoma brucei gambiense*

Side Effects: i.v.: immediate hypotension, nausea and vomiting; later, local pain at injection site, abscess formation, neutropenia (frequent in AIDS), thrombocytopenia, rash (rare), nephrotoxicity (mild azotemia to severe tubular necrosis), hepatitis with abnormal liver function tests, hypoglycaemia and hyperglycaemia, cardiotoxicity in 23% of patients treated for antimony-resistant kala azar, hypomagnesia, hypokalemia, acute pancreatitis, ventricular arrhythmias; severe hypocalcaemia with foscarnet; possible potentiation of toxic effects on rapidly growing cells (bone marrow, spermatogonia, germinal layers of skin and gastrointestinal mucosa) with ganciclovir; possible potentiation of nephrotoxicity (including acute renal failure) with amphotericin, cidofovir, foscarnet, other nephrotoxic agents; diabetes in 20% of patients treated for 3 weeks; increased risk of QT prolongation with all drugs capable of prolonging QT interval; dose adjustment required in renal failure, not in dialysis (except continuous venovenous or arteriovenous haemodialysis); aerosolised: bronchospasm, acute pancreatitis, mild hypoglycaemia, increased risk of spontaneous pneumothorax; safety in pregnancy not established

Contraindications: avoid in breastfeeding (insufficient data)

ALLOPURINOL

Indications: isolated skin lesions due to *Leishmania braziliensis*, *Leishmania mexicana*; visceral leishmaniasis

Side Effects: skin rash, mild fever, dyspepsia, nausea, vomiting, colic, diarrhoea, drowsiness, headache, peripheral neuritis, liver enlargement

KETOCONAZOLE

Indications: isolated skin lesions due to *Leishmania braziliensis*, *Leishmania mexicana*

Side Effects: see Chapter 22

INTERLEUKIN 2

Indications: isolated skin lesions due to *Leishmania braziliensis*, *Leishmania mexicana*

METHYLBENZETHONIUM

Indications: localised skin lesions due to *Leishmania tropica*

GAMMA INTERFERON

Indications: visceral leishmaniasis

MILTEFOSINE: oral

Indications: visceral leishmaniasis

PYRIMETHAMINE-SULPHADIAZINE

Indications: *Toxoplasma* brain and epidural abscess, encephalitis (80-90% effective), meningitis, retinochoroiditis, infections in pregnancy

Side Effects: seen in 30-45% of patients; severe skin rash, leucopenia, thrombocytopenia, elevated levels of serum transaminases, bone marrow toxicity, pancytopenia, megaloblastic anaemia

SULPHONAMIDES

Indications: cerebral toxoplasmosis in AIDS

Side Effects: see Chapter 21

AZITHROMYCIN: macrolide

Indications: treatment of cerebral toxoplasmosis in AIDS

Side Effects: see Chapter 21

COTRIMOXAZOLE

Indications: enteritis due to *Isospora belli*, *Toxoplasma gondii*; toxoplasmosis (including anterior uveitis, brain and epidural abscess, hydrocephalus, hepatitis and hepatic granuloma, pancreatitis, prophylaxis in AIDS); in WHO Model List of Essential Drugs

Side Effects: see Chapter 21

SPIRAMYCIN: macrolide

Indications: enteritis due to *Cryptosporidium*, toxoplasmosis (including meningitis, pancreatitis)

Side Effects: see Chapter 21

ERYTHROMYCIN: macrolide

Indications: enteritis due to *Cryptosporidium*

Side Effects: see Chapter 21

ROXITHROMYCIN: macrolide

Indications: enteritis due to *Isospora belli*

Side Effects: see Chapter 21

5-FLUOROURACIL

Indications: *Toxoplasma* encephalitis

Side Effects: diarrhoea, nausea, vomiting, alopecia, dermatitis, pigmentation, changes in nails, ataxia, fever, leucopenia, thrombocytopenia, chest pain, tachycardia, breathlessness, arrhythmia, ECG changes

CLINDAMYCIN

Indications: babesiosis; *Toxoplasma* encephalitis and retinochoroiditis

Side Effects: see Chapter 21

DAPSONE

Indications: toxoplasmosis prophylaxis in AIDS

Side Effects: see Chapter 21

ATOVAQUONE: take with or after food (absorption enhanced); absorption reduced in patients with severe diarrhoea; plasma levels significantly reduced by metoclopramide, rifampicin

Indications: prophylaxis and treatment of *Plasmodium falciparum* malaria (in combination with proguanil)

Side Effects: occasional rash, fever, elevated liver function tests, abdominal pain, vomiting, nausea, diarrhoea, anorexia, headache, dizziness, myalgia; probably safe in pregnancy

Contraindications: avoid in breastfeeding (insufficient data)

EFLORNITHINE: in WHO Model List of Essential Drugs as complementary drug for use in rare disorders or in exceptional circumstances

Indications: African trypanosomiasis

CALCIUM FOLINATE

Indications: prevention of anaemia in treatment of toxoplasmosis with pyrimethamine + sulphonamides

BICANTHONE

Indications: *Schistosoma haematobium* infections

HYCANTHONE

Indications: schistosomiasis

METRIFONATE

Indications: schistosomiasis haematobium (cure rate 18% alone, 25% combined with niridazole)

Side Effects: nausea, vomiting, headache, possible haemolysis in subjects with glucose-6-phosphate dehydrogenase deficiency

Contraindications: pregnancy

OXAMNIQUINE: in WHO Model List of Essential Drugs; relatively expensive

Indications: schistosomiasis due to *Schistosoma mansoni*

Side Effects: toxicity is insignificant

NIRIDAZOLE

Indications: dracunculiasis; schistosomiasis due to *Schistosoma haematobium*, *Schistosoma japonicum*

PRAZIQUANTEL: in WHO Model List of Essential Drugs; oral (take with or after food); relatively expensive

Indications: biliary cirrhosis due to flukes; cholangitis and cholecystitis due to helminths; clonorchiasis; cysticercosis; enteritis due to *Diphyllobothrium*, flukes, *Hymenolepis*, *Taenia*; fascioliasis; paragonimiasis; schistosomiasis (including Katayama syndrome; all species; cure rate 47%); taeniasis (including neurocysticercosis)

Side Effects: drowsiness in 70%, mild abdominal pain in 43%, urge to defecate in 40%, diarrhoea in 30%, fever in 27%, nausea in 15-40%, vomiting in 15-17%, vertigo in 12-40%, hepatomegaly in 4.5%, pruritis in 3%, headache in 1.5-57%, rash in 1.5%, hypotension in 1.5%; dizziness, malaise, colic, elevated transaminases also common; focal seizures, motor weakness, skin reactions, eosinophilia, fever, anorexia, papilloedema rare; increased in presence of liver disease; alcohol increases risk of CNS toxicity; carbamazepine, phenytoin, chloroquine, dexamethasone decrease plasma levels; cimetidine increases plasma levels; increases risk of albendazole adverse effects; probably safe in pregnancy; safe in breastfeeding; dose modification not required in renal failure or in dialysis

TRICHLOROFON

Indications: urinary schistosomiasis

MELARSOPOL: in WHO Model List of Essential Drugs as main list drug to improve compliance

Indications: cerebral trypanosomiasis and haemorrhagic fever due to *Trypanosoma brucei rhodesiense*

Side Effects: very toxic; must only be given under medical supervision

SURAMIN SODIUM: in WHO Model List of Essential Drugs as main list drug for African trypanosomiasis and complementary antilarial drug when drugs in main list are known to be ineffective or inappropriate for given individual and for which specific expertise, diagnostic precision, individualisation of dosage or special equipment is required for proper use and for which adverse effects diminish benefit/risk ratio

Indications: African trypanosomiasis (special cases, including haemorrhagic fever); onchocerciasis (if ocular microfilariae present after diethylcarbamazine and nodulectomy)

Side Effects: nephrotoxic; must be given under medical supervision; routine urine tests needed to detect albumin losses which, if present, contraindicate further suramin treatment

NITROFURAZONE

Indications: CSF infection with *Trypanosoma brucei*

DIFLUOROMETHYLORNITHINE HYDROCHLORIDE MONOHYDRATE

Indications: CSF infection with *Trypanosoma brucei*

LAMPIT

Indications: American trypanosomiasis

BENZIMDAZOLE: in WHO Model List of Essential Drugs as drug for which adverse effects diminish benefit/risk ratio

Indications: American trypanosomiasis

NIFURTIMOX: in WHO Model List of Essential Drugs as drug for which specific expertise, diagnostic precision, or special equipment is required for use and which has limited indications or narrow spectrum of activity

Indications: American trypanosomiasis

DIETHYLCARBAMAZINE: in WHO Model List of Essential Drugs; oral (take with or after food)

Indications: antilarial; visceral larva migrans

Side Effects: nausea, dizziness; allergic reaction with fever, rashes and malaise may occur after first dose; may provoke encephalopathy in heavy infection with *Onchocerca volvulus*; Mazzotti reaction (intractable fever, pruritis, adenitis, iritis, hypotension) may occur (manage with antipyretics, antihistamines, analgesics); safety in pregnancy not established

Contraindications: renal disease

FLUBENDAZOLE

Indications: filariasis; infections with *Ascaris* (single dose cure rate 94%), hookworm (single dose cure rate 75%), *Trichuris* (cure rate 32%); onchocerciasis

Side Effects: severe reaction at site of injection, 'flu-like' reactions after treatment for 3-5 w

IVERMECTIN: in WHO Model List of Essential Drugs; oral (best taken with food)

Indications: antilarial; antihelminthic (single dose cure rate 100% for *Ascaris lumbricoides* and *Strongyloides stercoralis*, 50% for *Trichuris trichuria*, 20% for hookworm); onchocerciasis; Norwegian scabies; cutaneous larva migrans; head lice; gnathostomiasis

Side Effects: transient sensitivity reactions responding to analgesics and antihistamines in filariasis; more likely in treatment for onchocerciasis than for strongyloidiasis; nausea, diarrhoea, dizziness, pruritis common; constipation, vomiting, tremor, rash, fatigue uncommon; headache, postural hypertension, tachycardia, myalgia, facial and peripheral oedema, eye inflammation rare; safety in pregnancy not established; safe in breastfeeding

Contraindications: children < 15 kg

SODIUM ANTIMONY DIMERCAPTOSUCCINATE

Indications: fascioliasis; paragonimiasis; taeniasis

BITHIONOL

Indications: enteritis due to *Nanophyetus salmincola*; fascioliasis (including hepatitis and hepatic granuloma); paragonimiasis

HEXYLRESORCINOL

Indications: enteritis due to *Fasciolopsis buski*

TETRACHLOROETHYLENE

Indications: enteritis due to flukes

PIPERAZINE CITRATE

Indications: ascariasis (intestinal obstruction); enterobiasis

Side Effects: nausea, vomiting, diarrhoea, lack of muscular coordination, abdominal pain; rarely, dizziness, allergy, rash

Contraindications: epilepsy, renal failure, liver disease; caution in impaired renal function, psychiatric states, neurological disease

THIABENDAZOLE: benzimidazole; deleted from WHO Model List of Essential Drugs because of general toxicity; take with or after food (twice daily)

Indications: cutaneous larva migrans; dracunculiasis; parasitic hepatic granuloma; infections with helminths including *Anisakis*, *Echinococcus*, *Phocanema*, *Pseudoterranova*, *Strongyloides* (including enteritis, meningitis, diffuse interstitial pneumonia; cure rate 75-95%), *Trichostrongylus* and *Trichinella*; larval pneumonitis; spirometrosis; visceral larva migrans; toxocarasis

Side Effects: diarrhoea and colic common in heavily infected children; nausea, vomiting, headache uncommon; dizziness, pruritis, paraesthesia, cholestatic jaundice, elevated transaminases, allergic reactions, Stevens-Johnson syndrome, proteinuria, neutropenia, alopecia, thrombocytopenia rare; single case report of tinnitus; safety in pregnancy not established; may increase theophylline plasma levels; dose modification not required in renal failure or in dialysis

Contraindications: first trimester; children < 6 mo; avoid if breastfeeding (insufficient data)

ALBENDAZOLE: benzimidazole; for intraluminal infections, take on an empty stomach, otherwise with or after food (absorption enhanced); in WHO Model List of Essential Drugs; expensive

Indications: echinococcosis (in conjunction with surgery); infections with *Ancylostoma* (single dose cure rate 96%), *Ascaris* (single dose cure rate 96%), *Enterobius vermicularis*, *Necator* (single dose cure rate 90%), *Strongyloides stercoralis* (cure rate 48%), *Trichuris* (cure rate 76%); neurocysticercosis; prophylaxis in children in communities with heavy intestinal helminth exposure; trichinellosis (including myocarditis and pericarditis); filariasis; capillariasis; trichinosis; toxocarasis; cutaneous larva migrans; giardiasis

Side Effects: as for **THIABENDAZOLE**; increased by praziquantel; dose modification not required in renal failure; dose after intermittent haemodialysis

Contraindications: pregnancy, children < 6 mo

LEVAMISOLE: in WHO Model List of Essential Drugs as drug with limited indications or narrow spectrum of activity

Indications: halzoun; infections with *Ascaris*, *Enterobius*, hookworms, *Strongyloides*, *Trichuris*; lagochilascariasis

MEBENDAZOLE: benzimidazole; in WHO Model List of Essential Drugs; broad spectrum; for intestinal worms, take on an empty stomach; for systemic infections, take with or after food; possible increase in plasma levels due to inhibition of metabolism with cimetidine

Indications: eosinophilic meningitis; larval pneumonitis; worms other than tapeworms (including *Ascaris* (cure rate > 90%), *Enterobius*, hookworm (cure rate 81-95%), *Strongyloides stercoralis*, *Taenia solium*, *Trichinella*, *Trichuris* (cure rate 90%))

Side Effects: as for **THIABENDAZOLE**; carbamazepine, phenytoin decrease plasma levels; cimetidine increases plasma levels; safety in pregnancy not established; safe in breastfeeding; dose modification not required in renal failure or in dialysis

Contraindications: first trimester, children < 6 mo, patients who have experienced allergic reactions to it

LOPERAMIDE

Indications: treatment of diarrhoea preparatory to treatment with mebendazole in *Trichuris trichuria* enteritis

Side Effects: usually minor and self-limiting; constipation, CNS depression, gastrointestinal irritation with overdose

DEXAMETHASONE

Indications: eosinophilic meningoencephalitis; neurocysticercosis

OXANTEL PAMOATE

Indications: infections with *Ascaris* (cure rate 21%), hookworm (cure rate 38%), *Trichuris* (single dose cure rate > 70%)

PYRANTEL (EMBONATE AND PAMOATE): in WHO Model List of Essential Drugs; oral (take with or after food)

Indications: cutaneous larva migrans; eosinophilic meningitis; infections with *Ancylostoma duodenale* (single dose cure rate 97-98%), *Ascaris* (single dose cure rate > 90%), *Enterobius*, *Necator americanus* (single dose cure rate 74-75%); larval pneumonitis; prophylaxis in children in communities with heavy intestinal helminth exposure

Side Effects: nausea, vomiting, abdominal discomfort/cramps, diarrhoea, headache common; dizziness, drowsiness, anorexia, tenesmus, rash, insomnia, fatigue rare; occasional minor abnormalities of liver function (elevated transaminases); safety in pregnancy not established; safe in breastfeeding and in children < 6 mo

PREDNISONE

Indications: cutaneous larva migrans; neurocysticercosis; spirometrosis

METHYLPREDNISOLONE ACETATE

Indications: intraocular *Taenia solium* cysts (periocular)

CONBENDAZOLE

Indications: intestinal roundworm infections

ETHYL CHLORIDE

Indications: cutaneous larva migrans and spirometrosis (topical)

FEBANTEL

Indications: intestinal roundworm infections

PYRVINIUM EMBONATE AND PAMOATE

Indications: enteritis and vaginitis due to *Enterobius vermicularis*

NICLOSAMIDE: take with or after food; in WHO Model List of Essential Drugs

Indications: infections with tapeworms including *Diphyllobothrium*, *Hymenolepis nana*, *Nanophyetus salmincola*, *Taenia*, tongue worms

Side Effects: rarely, abdominal pain, nausea, vomiting; probably safe in pregnancy

BENZYL BENZOATE: in WHO Model List of Essential Drugs

Indications: pediculosis, scabies; all household members should be treated

Side Effects: occasional skin sensitisation; safe in children; safety in pregnancy not established; caution in breastfeeding (prefer permethrin)

CROTAMITON

Indications: scabies in patient < 2 mo

Side Effects: safety in pregnancy not established

LINDANE (GAMMA BENZENE HEXACHLORIDE)

Indications: grain itch, pediculosis pubis, scabies

Side Effects: eczematous eruptions due to sensitisation; seizures; aplastic anaemia; safety in pregnancy not established

Contraindications: lactation, children < 2 y.o.

MALDISON

Indications: pediculosis and phthiriasis

Side Effects: safety in pregnancy not established

Contraindications: avoid if breastfeeding (insufficient data)

PYRETHRIN

Indications: fogging of sources of infestations

Contraindications: safety in pregnancy and lactation not established

PYRETHRINS + PIPERONYL BUTOXIDE

Indications: pediculosis and phthiriasis; safe in children; safety in pregnancy not established

PERMETHRIN: in WHO Model List of Essential Drugs

Indications: infestations

Side Effects: safety in pregnancy not established; safe in breastfeeding

SULPHUR

Indications: scabies in patient < 2 mo

AMITRIPTYLINE

Indications: ciguatera fish poisoning

Side Effects: the wide range of adverse reactions, affecting all organ systems, attributable to amitriptyline are unlikely to be seen with the suggested regimen (except, perhaps, for drowsiness and anticholinergic effects)

ANTITOXIN

Indications: tick paralysis

DIETARY RESTRICTION

Indications: acute diarrhoea and/or vomiting

DRAINAGE

Indications: amoebic hepatic abscess if no response to chemotherapy after 5 d, abscess > 10 cm or suspected impending rupture

ETHANOL

Indications: echinococcosis (injected into cyst and reaspirated)

EXCHANGE TRANSFUSION

Indications: babesiosis; malaria due to chloroquine resistant *Plasmodium falciparum*

EXCISION

Indications: thyroiditis

INTRAVENOUS FLUIDS

Indications: dehydration in acute diarrhoea and/or vomiting

REHYDRATION

Indications: dehydration in acute diarrhoea and/or vomiting

SURGERY

Indications: cerebral spirometrosis; echinococcosis; hydrocephalus due to *Toxoplasma gondii*; neurocysticercosis with ventricular involvement or raised intracranial pressure; parasitic eye infections; raised intracranial pressure due to hydatid cyst; trichinellosis