

of 90 to 95%. Good as such results are, a single dose or one day's sole treatment should not be considered to be all that is required to achieve a permanent cure or prevent re-infection, and any treatment plan should be reassessed after 6 or 12 months.<sup>3,4</sup> Such an approach with annual screening and targeted chemotherapy can provide, at least in some endemic areas, successful protection for children against intense infection and consequent hepatic disease.<sup>4</sup>

Several studies indicate that doses lower than those recommended above might be effective and in some control programmes 20 mg/kg might be enough for *S. haematobium*<sup>5-7</sup> or 30 mg/kg for *S. mansoni*.<sup>5</sup> The extent to which low doses contribute to resistance, as has been suggested with oxamniquine,<sup>8</sup> is unclear, but refractory infections have been reported. A 4-day treatment course was needed to produce a complete cure in a patient who relapsed twice following standard one-day treatment regimens.<sup>9</sup> Hepatic impairment, specifically hepatic fibrosis, is a feature of some schistosomal infections and patients with such liver involvement have benefited from treatment with praziquantel.<sup>4,10</sup>

1. WHO. The control of schistosomiasis: second report of the WHO expert committee. *WHO Tech Rep Ser* 830 1993.
2. Doenhoff MJ, Pica-Mattocia L. Praziquantel for the treatment of schistosomiasis: its use for control in areas with endemic disease and prospects for drug resistance. *Expert Rev Anti Infect Ther* 2006; **4**: 199–210.
3. Anonymous. The chemotherapy of schistosomiasis control. *Bull WHO* 1986; **64**: 23–5.
4. Anonymous. Mass treatment of schistosomiasis with praziquantel. *WHO Drug Inf* 1988; **2**: 184–5.
5. Taylor P, et al. Efficacy of low doses of praziquantel for Schistosoma mansoni and S. haematobium. *J Trop Med Hyg* 1988; **91**: 13–17.
6. King CH, et al. Dose-finding study for praziquantel therapy of Schistosoma haematobium in Coast Province, Kenya. *Am J Trop Med Hyg* 1989; **40**: 507–13.
7. Hatz C, et al. Ultrasound scanning for detecting morbidity due to Schistosoma haematobium and its resolution following treatment with different doses of praziquantel. *Trans R Soc Trop Med Hyg* 1990; **84**: 84–8.
8. Coles GC, et al. Tolerance of Kenyan Schistosoma mansoni to oxamniquine. *Trans R Soc Trop Med Hyg* 1987; **81**: 782–5.
9. Murray-Smith SQ, et al. A case of refractory schistosomiasis. *Med J Aust* 1996; **165**: 458.
10. Zwingenberger K, et al. Praziquantel in the treatment of hepatosplenic schistosomiasis: biochemical disease markers indicate deceleration of fibrogenesis and diminution of portal flow obstruction. *Trans R Soc Trop Med Hyg* 1990; **84**: 252–6.

**Taeniasis.** Praziquantel is used in the treatment of taeniasis (p.139). It has been studied in the mass control of taeniasis when a single dose of 5 mg/kg was used.<sup>1</sup>

Praziquantel is also effective against the larval form of *Taenia solium* and is used to treat neurocysticercosis (see above).

1. Cruz M, et al. Operational studies on the control of Taenia solium taeniasis/cysticercosis in Ecuador. *Bull WHO* 1989; **67**: 401–7.

## Preparations

**USP 31:** Praziquantel Tablets.

**Proprietary Preparations** (details are given in Part 3)

**Arg.:** Prazitral; **Austral.:** Biltricid; **Braz.:** Cestox; Cisticid; **Canad.:** Biltricid; **Chile:** Cesol; Cisticid; **Fr.:** Biltricid; **Ger.:** Biltricid; **Cesol:** Cysticid; **Gr.:** Biltricid; **Hong Kong:** Biltricid; **Israel:** Biltricid; **Mex.:** Bio-Cest; **Cesol:** Cisticid; **Extiser-Q†:** Prozelit; **Tecprazin;** Teniken; **Zifartel:** **Neth.:** Biltricid; **Rus.:** Biltricid (Билтрицид); **S.Afr.:** Biltricid; **Cysticide:** **Thai.:** Mycotricide; **Opticide;** **Praquantel;** **Praskon;** **Prazite;** **Wormicide;** **USA:** Biltricid; **Venez.:** Cestox; Cisticid†.

## Pyrantel Embonate (BAN, rINNM)

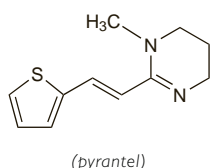
CP-10423-16; Embonato de pirantel; Pirantel Pamoat; Pirantel Pamoate; Pirantelio embonatas; Pyranteliembonaatti; Pyrantel, embonate de; Pyrantel Pamoate (USAN); Pyranlemonbonat; Pyrantel-embonat; Pyranteli embonas; Pyrantelu embonian. 1,4,5,6-Tetrahydro-1-methyl-2-[(E)-2-(2-thienyl)vinyl]pyrimidine 4,4'-methylenebis(3-hydroxy-2-naphthoate).

Пирантела Эмбонат

$C_{11}H_{14}N_2S, C_{23}H_{16}O_6 = 594.7$ .

CAS — 15686-83-6 (pyrantel); 22204-24-6 (pyrantel embonate); 33401-94-4 (pyrantel tartrate).

ATC — P02CC01.



**Pharmacopoeias.** In *Chin.*, *Eur.* (see p.vii), *Int.*, *Jpn.*, and *US*. **Ph. Eur. 6.2** (Pyrantel Embonate). A pale yellow or yellow powder. Practically insoluble in water and in methyl alcohol; soluble in dimethyl sulfoxide. Protect from light.

**USP 31** (Pyrantel Pamoate). A yellow to tan solid. Practically insoluble in water and in methyl alcohol; soluble in dimethyl sulfoxide; slightly soluble in dimethylformamide. Protect from light.

## Adverse Effects and Precautions

The adverse effects of pyrantel embonate are generally mild and transient. The most frequent are gastrointestinal effects such as nausea and vomiting, anorexia, abdominal pain, and diarrhoea. Other adverse effects reported include headache, dizziness, drowsiness, insomnia, skin rashes, and raised liver enzyme values.

Pyrantel embonate should be used with caution in patients with hepatic impairment.

## Interactions

The anthelmintic effects of both pyrantel and piperazine may be antagonised when the two drugs are used together.

## Pharmacokinetics

Only a small proportion of a dose of pyrantel embonate is absorbed from the gastrointestinal tract. Up to about 7% is excreted as unchanged drug and metabolites in the urine but over half of the dose is excreted unchanged in the faeces.

## Uses and Administration

Pyrantel embonate is an anthelmintic effective against intestinal nematodes including roundworms (*Ascaris lumbricoides*), threadworms (*Enterobius vermicularis*), and *Trichostrongylus* spp., the tissue nematode *Trichinella spiralis*, and hookworms, although it is possibly less effective against *Necator americanus* hookworms than against *Ancylostoma duodenale*. Pyrantel embonate is one of the anthelmintics that may be used in the treatment of infections with these worms, as discussed under Choice of Anthelmintic, p.134. It appears to act by paralyzing susceptible worms which are then dislodged by peristaltic activity.

Pyrantel is given orally as the embonate, but doses are described in terms of the base. Pyrantel embonate 2.9 g is equivalent to about 1 g of pyrantel.

Single or mixed infections due to susceptible worms in adults and children may be treated with the equivalent of pyrantel 10 mg/kg as a single oral dose. Ascariasis occurring alone may only require 5 mg/kg; a single dose of 2.5 mg/kg given three or four times a year has been used in mass treatment programmes. In necatoriasis, 10 mg/kg daily for 3 or 4 days or 20 mg/kg daily for 2 days may be necessary. The response in enterobiasis may be improved by repeating the 10 mg/kg dose after 2 to 4 weeks. In trichinosis, a dose of 10 mg/kg daily for 5 days has been used.

Pyrantel tartrate has been used as a veterinary anthelmintic.

## Preparations

**USP 31:** Pyrantel Pamoate Oral Suspension.

**Proprietary Preparations** (details are given in Part 3)

**Arg.:** Aut†; **Austral.:** Anthel; **Combantrin;** Early Bird; **Austria:** Combantrin; **Braz.:** Ascaric; **Canad.:** Combantrin; **Jaa Pyrat;** **Chile:** Combantrin; **Fr.:** Combantrin; **Helminthox;** **Ger.:** Helmix; **Gr.:** Combantrin†; **Hong Kong:** Combantrin; **Pyrantin;** **Pyrantin†;** **India:** Nemocid; **Indon.:** Combantrin; **Konvermix;** **Medicombin;** **Piraska;** **Proworm;** **Israel:** Combantrin†; **Ital.:** Combantrin; **Mex.:** Combantrin; **Pirantrim;** **NZ:** Combantrin; **Philipp.:** Combantrin; **Gelminthix;** **Port.:** Combantrin; **Vertel†;** **Rus.:** Helminthox (Гельминтокс); **Nemocid** (Немочида); **S.Afr.:** Combantrin; **Singapore:** Bearantel; **Spain:** Lombriareu; **Trilombin;** **Switz.:** Cobantril; **Thai.:** Bantel†; **Pyrapam;** **Turk.:** Kontik; **USA:** Antimint†; **Pin-Rid;** **Pin-X;** **Reese's Pinworm;** **Venez.:** Combantrin; **Etimex†;** **Pamoval†;** **Pleosan†;** **Tamoa;** **Ten-ečaj†.**

**Multi-ingredient:** **India:** Mebex Plus; **Indon.:** Quantrel; **Philipp.:** Quantrel; **Venez.:** Dualid; Quantrel.

## Pyrvinium Embonate (rINNM)

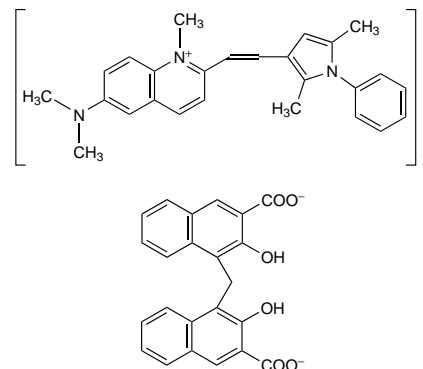
Embonato de pirvinio; Pirvinium Pamoat; Pyrvinii Embonas; Pyrvinium, Embonate de; Pyrvinium Pamoate (BAN); Vipryinium Embonate; Vipryinium Pamoate. Bis{6-dimethylamino-2-[2-(2,5-dimethyl-1-phenylpyrrol-3-yl)vinyl]-1-methylquinolinium} 4,4'-methylenebis(3-hydroxy-2-naphthoate).

Пирвиния Эмбонат

$C_{52}H_{56}N_6, C_{23}H_{14}O_6 = 1151.4$ .

CAS — 3546-41-6.

ATC — P02CX01.



**Pharmacopoeias.** In *US*.

**USP 31** (Pyrvinium Pamoate). A bright orange or orange-red to practically black crystalline powder. Practically insoluble in water and in ether; slightly soluble in chloroform and in methoxyethanol; freely soluble in glacial acetic acid; very slightly soluble in methyl alcohol. Store in airtight containers. Protect from light.

## Adverse Effects

Pyrvinium occasionally causes nausea, vomiting, abdominal pain, and diarrhoea. Hypersensitivity reactions and photosensitivity have been reported. Headache may occur.

Pyrvinium stains the stools bright red and may stain clothing if vomiting occurs.

## Pharmacokinetics

Pyrvinium embonate is not significantly absorbed from the gastrointestinal tract.

## Uses and Administration

Pyrvinium embonate is an effective anthelmintic in the treatment of enterobiasis (p.136), but has generally been superseded by other drugs.

Pyrvinium is given as the embonate but doses are described in terms of the base. Pyrvinium embonate 7.5 mg is equivalent to about 5 mg of pyrinium.

It has been given orally in a single dose equivalent to pyrinium 5 mg/kg, repeated after 2 to 3 weeks.

## Preparations

**USP 31:** Pyrvinium Pamoate Oral Suspension; Pyrvinium Pamoate Tablets.

**Proprietary Preparations** (details are given in Part 3)

**Arg.:** Tru; **Austria:** Molevac; **Braz.:** Enterocid†; **Pyr-Pam†;** **Pyvern;** **Canad.:** Vanquin†; **Denm.:** Vanquin; **Fin.:** Pyrin; **Fr.:** Rovany†; **Ger.:** Molevac; **Pyrcon;** **Norw.:** Vanquin; **Spain:** Pamoan; **Swed.:** Vanquin; **Turk.:** Pirok.

## Rafoxanide (BAN, USAN, rINN)

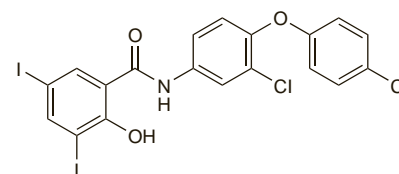
MK-990; Rafoxanida; Rafoxanidum. 3'-Chloro-4'-(4-chlorophenoxy)-3,5-di-iodosalicylanilide.

Рафоксанид

$C_{19}H_{11}Cl_2I_2NO_3 = 626.0$ .

CAS — 22662-39-1.

ATC Vet — QP52AG05.



## Profile

Rafoxanide is an anthelmintic used in veterinary medicine for the treatment of fascioliasis in cattle and sheep.