

Pyrantel Pamoate in Roundworm Infestations*

A COMPARATIVE TRIAL WITH PIPERAZINE CITRATE GIVEN IN A SINGLE DOSE

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SUMMARY

A controlled single-blind trial was carried out to compare the effect of single-dose therapy with pyrantel pamoate (Combantrin) and piperazine citrate in children infested with *Ascaris lumbricoides*. Fifty-six children were treated. Pyrantel pamoate was 96.4% effective and piperazine citrate 82.1% effective in eradicating *Ascaris lumbricoides* ova from 3 consecutive stools taken on the 7th, 8th and 9th days after treatment. If results of stool examination on the 9th day only are considered, pyrantel pamoate was 100% effective and piperazine citrate was 89.3% effective.

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Desowitz¹ reviewing antiparasite chemotherapy in 1971 predicted that pyrantel pamoate (Combantrin) 'will become one of the drugs of choice for the treatment of enterobius, ascariasis and possibly hookworm infections'. The literature on Combantrin is now extensive²⁻⁸ and the drug has been shown to be highly effective against ascariasis^{3,4} and enterobius,² and effective against hookworm^{4,5} infestations. This article reports the results of a trial to determine the efficacy of pyrantel pamoate in a single dose in children infested with *Ascaris lumbricoides*, and to compare the efficacy of pyrantel pamoate in a single dose with that of piperazine citrate given in a single dose.

The highest incidence of ascariasis infestation occurs in communities living in areas where hygiene is poor and waterborne sewerage deficient.⁹ *Entokozweni* (Zulu: 'Place of Joy'), a crèche and welfare centre in Alexandra Township, near Johannesburg, was chosen for this study. The crèche cares for 125 Bantu children (mostly Sotho, Venda, Zulu and Shangaan) aged 2-6 years. In 1971 there were approximately 64 000 people living in Alexandra Township, which covers an area of 3 626 hectares.¹⁰ Sewage disposal is by means of bucket collection 2 or 3 times a week. A very small proportion of buildings, mainly factories and clinics on the outskirts of the township, have waterborne sewerage serviced by a vacuum-tank system.¹⁰ The children in the area often simply squat in the field or near the open drains on the side of the road when passing urine or faeces, since the buckets are often reserved 'for adults only'.

MATERIALS AND METHODS

Stools from 125 children attending the crèche were examined for the presence of *Ascaris lumbricoides* ova and the children with ova were included in the trial (Table I).

TABLE I. PRE-TREATMENT EXAMINATION OF SINGLE STOOL SPECIMENS FROM 125 CHILDREN ATTENDING ENTOKOZWENI CRÈCHE

Number of children attending crèche	125
Number of stools examined	125
<i>Ascaris lumbricoides</i> found in	60
<i>Taenia saginata</i> found in	5
<i>Schistosoma mansoni</i> found in	2
<i>Ankylostoma duodenale</i> found in	2

The stools were initially examined by the direct and the acetic acid-ether concentration methods and, if ascariasis ova were present, a pre-treatment ova count was performed on 3 g quantities. A modification of the syringe technique described by Layrisse *et al.*¹¹ was employed. The ends of a 10-ml spring-loaded plastic syringe were cut off and, by weighing, were calibrated and marked. The syringe was filled with 3 g of faeces by placing its end with the plunger depressed against the spring, in the specimen and allowing it to fill by releasing the plunger until the 3 g mark was reached. Consistent results were obtained with formed but not with unformed stools. However, none of the children in the trial had the latter type of stool. Occasionally the stools were of a consistency which required filling of the syringe by means of a spatula.

The contents of the syringe were expressed into a glass container and made up to a volume of 45 ml with 0.1N NaOH. The mixtures were shaken after the addition of glass beads and then filtered through 60-mesh copper gauze. Aliquots of the stool suspension were counted in both chambers of a McMaster egg-counting slide.

During the trial post-treatment specimens of stool were immediately subjected to this ovum counting method. Since counts of less than 50 ova/g of stool may not be detected by this method, specimens which appeared to give negative results were then re-examined by the acetic acid-ether concentration technique for confirmation of the negative findings.

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TREATMENT

Children infested with *Ascaris lumbricoides* were chosen for a single dose treatment on either a pyrantel pamoate or a piperazine citrate regimen. The following dose schedule was used:

Pyrantel: 10 mg/kg given in one dose. Since the children in the trial mostly weighed 15-25 kg, a single teaspoonful containing 250 mg was given in one dose.

or

Piperazine citrate: 4 teaspoonfuls, 500 mg/teaspoon, given in one dose (2,0 g).

Patient Selection

The patients were classified according to their egg load.

TABLE II. NUMBER OF CASES ASSIGNED TO EACH DRUG GROUP GRADED ACCORDING TO OVUM COUNTS IN STOOLS POSITIVE FOR *ASCARIS LUMBRICOIDES* BEFORE TREATMENT

Ovum count	No. of cases assigned for treatment with:	
	Piperazine citrate	Pyrantel pamoate
0 - 1 000	9	9
1 001 - 2 000	2	2
2 001 - 3 000	2	2
3 001 - 4 000		
4 001 - 5 000	1	2
5 001 - 6 000	1	1
6 001 - 7 000		
7 001 - 8 000	1	
8 001 - 9 000	2	1
9 001 - 10 000		2
10 000 - 20 000	6	6
20 000 - 100 000	5	3
100 000	1	2

Patients were then assigned to either the pyrantel pamoate or the piperazine citrate treatment regimen by a selection based on the pre-treatment worm load, so that as far as possible the ascaris egg load in each group would be comparable (Table II). The laboratory technicians who examined subsequent stools were not informed which treatment had been given. The trial was therefore a comparative double-blind trial.

RESULTS

Criteria of Cure

In the protocol for this trial a cure was defined as daily ovum-free stools on the 7th, 8th and 9th days following treatment. In the majority of patients we succeeded in obtaining stools in this manner. In the few cases where stool collections were not possible on these days (due to absenteeism or failure to produce a stool),

stools were collected as soon as possible after the 9th day.

Stools from the 125 children attending the crèche were examined. Sixty were positive for ascaris. Thirty children were assigned to the pyrantel pamoate group and 30 to the piperazine citrate group.

Two children in the pyrantel pamoate group and 2 children in the piperazine citrate group were not present on the days of treatment and were therefore omitted from the trial. Three follow-up specimens were obtained from all the treated children except from one in the piperazine citrate group, who supplied only two follow-up specimens. As both stools from this child were negative for ascaris ova this case was included among the cures.

With the above considerations in mind, the following results were obtained (Table III).

TABLE III. RESULT OF TREATMENT

A. According to criteria laid down in protocol

	Cures	Failures	Total
Pyrantel pamoate	27	1	28
Piperazine citrate	23	5	28

Difference: 4

$t = 1,67, P = 5\%$ (1-tailed)

B. If cases 30, 88 and 58 are regarded as cures (see note to Table IV), then the results of treatment are as follows:

	Cures	Failures	Total
Pyrantel pamoate	28	0	28
Piperazine citrate	25	3	28

Difference: 3

$t = 1,77, P = 4\%$ (1-tailed)

In considering both of these, pyrantel pamoate is superior statistically to piperazine at at least the 5% level.

Note: In both the above a 1-tailed test was used since the hypothesis being tested is that pyrantel pamoate is superior to piperazine citrate.

Ovum counts were recorded in the cases considered as failures. (Table IV).

TABLE IV. STOOL OVUM COUNTS IN CASES REGARDED AS FAILURE OF TREATMENT

Case	Pre-treatment stool	Post-treatment stool			
		1st	2nd	3rd	
Piperazine citrate	12	17 700	600	1 300	1 600
	30	11 200	600	2 100	0
	76	200	2 300	2 800	2 700
	88	1 800	6 600	200	0
	119	4 300	400	7 200	2 400
Pyrantel pamoate	58	12 900	100	0	0

Note: Case 8 and perhaps case 30 for piperazine citrate, and case 58 for pyrantel pamoate, could conceivably be designated as cures, though not according to the criteria laid down in the trial protocol. It would appear as though 100% cure is possible with a single dose of pyrantel pamoate.

No untoward drug effects were noted after treatment by either the staff of the crèche or the parents in the 2 groups of children studied.

DISCUSSION

Bell and Nassif³ treated 119 ascaris-infested subjects with pyrantel pamoate 10 mg/kg and achieved a cure rate of 100%, as judged by stool examination on the 10th day following treatment. However, they found that stool examinations did not become negative for the presence of ova until the 10th day. On day 8, 97.4% of stools were clear and on days 9 and 10 following treatment, all stools were free of ova. This finding is of interest in relation to our study. Our only 'failure', case 58 (Table IV) had ova in the stool on day 7, but not on day 8 or day 9. Therefore, a claim for 100% cure from ascaris infestation would appear to be justified if judged by stool examination on the 9th or subsequent day following pyrantel pamoate treatment. In Bell and Nassif's series, the egg counts in the piperazine citrate treated patients did not drop after the 3rd day and stool examination on the 10th day continued to show the presence of ova in the stools of 28.8% of cases.

Piperazine citrate given in more than one dose is highly effective, and if one were to compare pyrantel pamoate in a single dose with piperazine citrate given in 2 doses,

then pyrantel pamoate would demonstrate only a marginal advantage. However, there are obvious advantages to using a drug which is effective when given in a single dose, especially when mass treatment is to be undertaken.

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