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Chemotherapeutic trial to control enterobiasis in schoolchildren

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Abstract: To assess several chemotherapeutic schemes for control of enterobiasis, 738 children in five primary schools in Chunchon, Korea, were studied from May 1994 to June 1995. They were divided into 6 groups by the schemes: treatment of once or twice a year; treatment of positive cases or of whole class students; treatment with or without family members. The overall egg positive rate before intervention was 17.5% out of 789 children. Treating all individuals in a class together with family members of positive cases brought better control efficacy than other schemes (p=0.000). However, when egg positive rate is less than 30%, treating only egg positive cases also can reduce egg positive rate. The confounding factors for the enterobiasis control in primary schoolchildren were new-comer to a class and familial infection.

Key words: *Enterobius vermicularis*, chemotherapy, control, mebendazole

INTRODUCTION

To control highly endemic enterobiasis in a group or an institute such as orphanage, repeating treatments at least three times with an interval of three weeks and treating whole members of the group should be considered together with improving personal hygiene. When infected new-comers are introduced, the chemotherapeutic regime was repeated 3 to 9 months after their coming depending on the degree of endemicity (Hong *et al.*, 1979 & 1980; Kim *et al.*, 1982). Pawlowsky (1987) classified enterobiasis into four categories and suggested treatment schemes as follows: 1) sporadic enterobiasis, which needs a single treatment, 2) recurrent enterobiasis, non-intensive, not involving family members, which needs two treatments two weeks apart, eventually repeated after 2-3 months, 3) well-established family enterobiasis, which requires 3 or 4 treatments 2 weeks apart, and 4) recurrent professional enterobiasis in teachers and nurses which needs a single treatment every 2 months.

In the case of endemic enterobiasis of schoolchildren, it is difficult to determine the status of real infection due to limiting sensitivity of perianal swab in diagnosis of enterobiasis. Positive perianal swab detects only parasitism terminated adult female infection. Therefore, egg negative cases of anal swab may need chemotherapy in some occasions (Cho and Kang, 1975). To make more efficient con-

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trol of enterobiasis, blanket chemotherapy of whole individuals of a group is recommended (Hong *et al.*, 1979). However, treatment of uninfected individuals is not necessary and their number may be larger than that of infected ones in low endemic populations. In a mass screening and chemotherapy for enterobiasis in schoolchildren, it is necessary to determine whether mass chemotherapy is needed or not when a child is egg positive in a class. The necessity of treatment of the family members of a positive should be also determined. In the present study, schoolchildren were subjected for evaluation of treatment frequency and target population.

MATERIALS AND METHODS

Five primary schools in Chunchon, Korea were included in this study. The schoolchildren were divided into six groups: (A) treating only egg positive cases once, (B) treating only positive cases and repeating 6 months later, (C) treating positive cases with all of their family members once, (D) treating positive cases with all of their family members and repeating 6 months later, (E) treating all classmates and family members of positive cases once, (F) treating all classmates and their families and repeating 6 months later. Each group was examined by perianal swab one year after the first examination. This study was done from May 1994 to June 1995. For each child, perianal swab was secured two times in two days of interval before application of treatment and one year after that. One positive finding from either examination was regarded as positive and subjected to the treatment.

Each treatment consisted of three times of single dose mebendazole 100 mg in three weeks interval. Fisher's exact test was used to compare the conversion rate between positive and negative between treatment groups. Only the children with both examinations (pre-and post-treatment) were included in the analysis.

RESULTS

As summarized in Tables 1 & 2, results of each group were classified into four outcomes; positive to positive, positive to negative, negative to positive and negative to negative. In Table 2, to avoid the effect of new-comers or transferred children to treatment outcome, the statistical analysis was done with only children who were subjected in both the beginning and the end of examination. Equality of proportions of the four outcomes between two treatment groups was conducted using Fischer's exact test, and p-values were shown in Table 3. Treating all children with the family members of positive cases (EF) showed the better result than treating the positive cases only (AB) and treating the positive cases with their all family members (CD) (AB-EF, p=0.000, CD-EF, p=0.000). When positive

Table 1. Egg positive rates of *E. vermicularis* after one year according to modes of treatment

Scheme of treatment[a)]	Number of positive/examined (%)		Egg negative conversion rate (%)
	before treatment	one year after the control	
A	27/181 (14.9)	37/404 (9.2)	38.3
B	23/222 (10.4)	4/214 (1.9)	85.4
C	9/68 (13.2)	6/69 (8.7)	34.1
D	24/167 (14.4)	9/146 (6.2)	56.9
E	26/56 (46.4)	3/53 (5.7)	87.7
F	29/95 (30.5)	7/93 (7.5)	75.4
Total	138/789 (17.5)	66/979 (6.7)	61.7

[a)]A, treating only egg positive cases once; B, treating only egg positive cases and repeating 6 months later; C, treating egg positive cases with their family members once; D, treating egg positive cases with their family members and repeating 6 months later; E, treating all classmates together with family members of the egg positive cases once; F, treating all classmates together with family members of egg positive cases and repeating 6 months later.

Table 2. Number of cases in each category of changing egg examination findings of *E. vermicularis* after one year according to the modes of treatment

Group	p-p[a)]	p-n	n-p	n-n	sum	in+	in-	out+	out -
A	2	25	12	142	181	23	200	0	0
B	1	17	3	191	212	0	2	5	5
C	2	7	3	54	66	1	2	0	2
D	4	17	4	120	145	1	0	3	19
E	3	22	0	28	53	0	0	1	2
F	2	21	2	56	81	3	9	6	8
Total	14	109	24	591	738	28	213	15	36

Explanation of each group is same as that of Table 1.

[a)]p-p, number of students with constant positive result; p-n, number of students with negative conversion from positive result; n-p, number of students with positive conversion from negative result; n-n, number of students with constant negative result; sum, sum of p-p, p-n, n-n, and n-p; in+, number of new-comer with positive result; in-, number of new-comer with negative result; out+, number of transfer student with positive result; out-, number of transfer student with negative result.

Table 3. P-values of two-tailed Fisher's exact test between groups

Groups	p-value
AB-CD	0.256
AB-EF	0.000
CD-EF	0.000
A-B	0.004
C-D	0.898
E-F	0.103

Explanation of each group is same as that of Table 1.

cases only were treated, the repeated treatment at 6 months interval (B) gave the better result than treating positive case only once a year (A) (A-B p=0.004). When only positive cases were treated (AB), concomitant treatment of their family members (CD) showed no significant difference (AB-CD, p=0.256). When positive cases were treated with their family members (CD), repetition of treatment every 6 months (D) did not show the significant difference (C-D, p=0.898). Also When treating all children of a class and the families of positive ones (EF), the repeated treatment of 6 months interval (F) did not improve the result (E-F, p=0.103). There were a total of 28 egg positive cases (11.6%) out of 241 new comers in the study group (Table 2).

DISCUSSION

The egg positive rate before intervention 17.5% out of 789 children in this study showed that the enterobiasis is still endemic not only in the rural area but also in the urban area in Chunchon. The overall egg positive rate of *E. vermicularis* in the first screening was 19.9% out of 1,262 examinees in Kangwon-do (Kim *et al.*, 1991). The egg positive rate in anal swab was 16.0% out of 2,156 schoolchildren in Seoul and Kyonggi-do (Ryang, 1988). Nationwide survey in 1992 showed that the egg positive rate of *E. vermicularis* is 4.3% in 5-9 years old group and 2.0% in 10-14 years old group (Ministry of Health and Social Affairs, and Korea Association of Health, 1993). According to the above findings, we confirm that there are still many endemic areas of enterobiasis in Korea.

Follow-up examination one year after the first one was conducted due to the following reasons: 1) Usually there are new-comers at the beginning of the first semester of the primary school. 2) Also a chemotherapeutic study for orphanages showed 6 months or one year follow-up study can reveal effect of the infected new-comer in the group (Hong *et al*, 1980). 3) For the assessment of the therapeutic effect, the interval of 6 months for a large number of schoolchildren is practically hard to be done. Due to ethical reason, we could not set a con-

trol group without any intervention or placebo subscription, which may be necessary to confirm the natural decrease of the egg positive rate in a certain group. Usually for the assessment of chemotherapeutic effect for enterobiasis, the subjected group should be stable without any change of the members. However, usually in primary schools, there is a relocation of classes every year. Therefore, we put any same grade children in the same school as one group.

For assessment of overall egg positive rate, total egg negative conversion rate was 61.7%. The egg positive rates of all groups decreased remarkably one year after. Treating twice a year (B, D, F) was better than treating once a year (A, C, E) (Table 1). However, in the selected children, repeating treatment 6 months later (D, F) showed no improved rate to treating once a year (C, E) (C-D, p=0.898, E-F, p=0.103, Table 3). This may be a result from the introduction of the infected new-comers. When positive children only were treated, the concomitant treatment of their family members was not necessary since there was no significant difference between AB and CD (p=0.256). In the assessment of control efficacy, treating all children with family members of positive cases was the best scheme.

In the assessment of transmissibility in primary schoolchildren, new-comers to a school may be a main source of infection. The infection cycle is believed to be sustained not only at home but also at schools. The two peaks, one in the primary schoolchildren and the other in their parents age group in the egg positive rate of enterobiasis according to age also support this fact (Ministry of Health and Social Affairs, and Korea Association of Health, 1993). The present results suggested that treating all classmates and families of positive ones would be recommended for their rapid decrease of egg positive rate in schoolchildren group with over 30% of egg positive rate. If a class is not highly endemic, treatment of all classmates and their family members may not be reasonable. When the egg positive rate is low, selective treatment of positive cases also can reduce the egg positive rates. They were not affected by concomitant treatment of family members, undertaken to control familial transmission. Thus, the present result strongly suggests that the transmission of *Enterobius* is more rapid in a class than within a family if endemicity is low as positive rate less than 30%. More data should be accumulated to confirm this finding. The confounding factors in the assessment of control efficacy were number of new-comers and proportion of familial infection.

The interpretation in this study may be limited because of different positive rates among the groups, and no information for worm burden, of class reallocation of the children during the follow-up period, or of no data for family members. However, above data are believed to have provided a guideline to the mass screening and chemotherapy for enterobiasis of the primary schoolchildren.

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= 초록 =

초등학생 요충 감염증에 대한 집단 치료 양식

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초등학생 요충의 집단 검사와 치료시 진단 방법의 한계로 인하여 다음과 같은 점을 고려하여야 한다. 즉, 항문 주위 도말법 양성인 어린이와 같은 반의 어린이를 동시에 치료할 필요가 있는가? 양성인 어린이의 가족을 동시에 치료할 필요가 있는가? 일년에 한 번 검사 후 투약하는 것보다 검사 후 양성자는 치료를 6개월 후 한 번 더 반복하는 것이 나은가? 이런 질문에 답하기 위하여 양성자만 치료, 전 급우와 양성자 가족 동시 치료, 양성자와 양성자 가족 동시치료 이 세 가지를 한 번만 치료하는 것과 6개월 후에 반복하는 것으로 학생 집단을 나누어 일년 후 추적 검사하여 결과를 비교하였다. 그 결과, 모든 대상자를 양성자의 가족과 동시에 치료하는 것이 일년 후 양성률의 감소에 가장 효과적임을 알 수 있었다. 또한 요충 치료에서 감염자의 유입과 더불어 가족 감염이 매우 중요한 재감염의 요인임을 다시 한 번 확인할 수 있었다. 그러나 양성률이 30% 미만으로 낮은 집단에서는 양성자만 치료하는 것도 일년 뒤의 집단의 양성률을 낮추는 데 기여함을 알 수 있었다. 앞으로 대상 양성률이 낮을 때의 상황에 대한 조사가 더 필요하다.

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APPRECIATIONS TO PEER-REVIEWERS FOR VOLUME 35, 1997

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1997년도 제35권 상호심의에 참여하신 분께 감사드립니다.

기생충학잡지 제35권에 게재하기 위하여 투고된 논문 원고의 상호심의 (Peer Review)에 수고하신 아래의 여러 선생님께 감사드립니다. 선생님의 지적과 수정요구가 해당 논문의 저자에게도 도움이 되었고, 잡지 전체로는 물론이고 우리 학회의 학문적인 토론문화의 발전에도 크게 이바지 하였습니다. 물론 저자의 의도와 다른 견해를 무리하게 지적하거나 내용을 정확하게 이해하지 못하고 지적하는 경우도 간혹 있었으며, 그러한 경우에는 저자들이 신중하게 학술적인 견지에서 선별적으로 받아들여 별다른 무리없이 잡지가 발간되었습니다. 심의자 선정에서 가능하면 다른 학회의 전공자와 외국 기생충학자의 견해를 반영하고자 노력하였고, 앞으로도 그런 노력을 지속할 예정입니다. 금년도분 잡지 35권이 차질없이 4호까지 충실하게 날짜를 지켜서 발간할 수 있었음은 여러 회원의 적극적인 참여에 힘입은 것입니다. 이에 진심으로 감사드립니다. 우리 잡지가 투고 일자에 비하면 발간 일자가 가장 빠른 잡지이므로 앞으로도 좋은 논문을 계속 투고하여 주실 것으로 믿습니다.

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