Health problems in the forested mountains of southern Viet Nam

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Chapter 6

Intestinal helminth infections in an ethnic minority commune in southern Viet Nam.

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ABSTRACT

A program to control intestinal helminth infections, based on stool surveys, mass treatment of children below 17 years, improvement of sanitation and health education was performed between 1997 and 1999 in Phan Tien – an ethnic minority community in mountainous southern Viet Nam. Before interventions 28.6% of children excreted eggs of at least one parasite, hookworm being the most common (23%) followed by Trichuris trichiura (1.9%), Hymenolepis nana (1.9%), Enterobius vermicularis (0.9%), Ascaris lumbricoides (0.5%), and multiple helminths infection (0.5%). Strongyloides stercoralis was never detected. Poor sanitation and personal hygiene, and walking barefoot were considered the main risk factors for intestinal helminth infections.

The success of 400 mg albendazole single dose mass treatment was initially frustrated by poor quality of the used drug formulation, only containing half of the indicated amount of albendazole. Using another formulation quickly reduced the hookworm infection rate. Praziquantel was used to treat H. nana infections. After three years of intervention, intestinal helminth infections were reduced to 3.3% (p<0.0001). We conclude that interventions combining health education, improvement of sanitation and mass treatment effectively control intestinal helminth infections but that quality of the used drugs is an important factor.
INTRODUCTION

The successful malaria control program, initiated in 1994 in Phan Tien, a mountainous ethnic minority commune in southern Viet Nam, did not reduce the initially found 15% anemia prevalence in children as expected, suggesting another important cause of anemia.(1) Intestinal helminth infections (IHI) are very common in the remote rural areas of Viet Nam, associated with poor living conditions, poor sanitation and lack of knowledge. IHI is an important cause of anemia, especially among school-age children and adolescents, who are more frequently infected and with higher parasite densities than adults.(2)

Severe complications of IHI such as severe anemia, bowel obstruction, bile duct infection, pancreatic duct infection and pancreatitis are reported (3;4) but usually IHI evolve slowly and gradually and remain asymptomatic or mildly symptomatic. Consequently, detection and treatment of IHI are often neglected, giving way to a large burden of silent infections, especially in children. However, this may result in chronic anemia, reduced physical fitness and activity, impaired school performance, increased susceptibility to infection, and retarded growth in children.(2;5-7)

To assess the prevalence of infections by the different intestinal helminths in Phan Tien, and to determine the appropriate interventions, repeated surveys were conducted from 1997 onwards.

METHODS

Population and study site

Phan Tien, an ethnic minority community, is situated in Bac Binh district in the mountainous part of Binh Thuan province, in southern Viet Nam. In three years (Apr.1997– Dec.1999) the population increased from 907 to 1083 subjects, by immigration and a high birth rate (3.2% per year), approximately half of the population being younger than 15 years. Subsistence agriculture and forest work such as logging wood, was the main source of income of this commune. There was no health care facility before 1994 and no electricity before 2000.

Houses in Phan Tien are mainly made of clay walls and thatched roofs, without toilets or bathrooms. Animals and human excrements were disseminated in and around the village. Walking barefoot was common in Phan Tien, especially for infants and young children. People and cattle shared a small river surrounding the village as their water source for consumption, washing and agricultural irrigation. The capacity of three wells, drilled in 1994 with the aid of UNICEF, was insufficient, and two of them broke down in 1996 so that many inhabitants kept consuming river water. The rainy season runs from late April through November, followed by a dry season during which the river drops to very low levels and the water becomes turbid. The ambient temperature ranges from 20 to 35°C and humidity is high.
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This study comprised annually repeated stool examinations of all children in Phan Tien, younger than 17 years during an intervention program from April 1997 to December 1999. There were no exclusion criteria.

Feces examination surveys

Feces examination surveys were synchronized with the malaria surveys, at the end of the rainy season, but in 1997 two surveys were done, in April, at the end of dry season and in December, at the end of the wet season. Empty plastic containers were distributed to families with children at pre-school age. The older children received the containers at school. By checking the population registration it was ensured that all children received a container and were stimulated to return a fresh stool specimen. Fresh stool samples were immediately examined by the Willis and Kato-Katz thick smear techniques. The agar plate method was used to detect Strongyloides stercoralis. Any intestinal helminth infection was specified by infecting species.

Interventions

Water, sanitation and health education

In 1997, after the first survey a safe water supply program was initiated, providing new wells as well as fixing the old wells so that 8 functioning wells were available, enough to supply the complete population with clean water. At the same time five toilets and bathrooms were built at public places like the health post, the school and the office of the people’s committee, as examples to be imitated by the families of Phan Tien.

Health education was done throughout the surveys with information on the benefits on wearing of sandals/shoes, hand washing before meals and using clean water, maintenance of the household environment and save storage of food. This program was practiced by teachers in the primary school, during meetings of the women’s union and by the local medical staff. Moreover, health personnel visited families of infected members at home. Sandals/shoes were supplied free of charge to all during the surveys in Dec. 1997 and 1998.

Medical mass treatment

Mass treatment aimed at administration of albendazole to each individual of the population of Phan Tien presented at the time of the surveys which always included 100% of the school children. During the first mass treatment, given after the first survey of April 1997, albendazole (two tablets of 200 mg) of a local pharmaceutical company was used. The contents of the albendazole tablets were examined by standard High Performance Liquid Chromatography (HPLC) when the first mass treatment had not exerted any effect on the IHI rate. In the mass treatment campaigns of December 1997 and September 1998 a Korean product (a single tablet of 400 mg albendazole, Sudo Pharm. INDCO., LTD) was used. Hymenolepis nana infections were treated with praziquantel (50mg/kg) during the surveys of 1998 and 1999.
Data analysis

A full registration of all inhabitants was kept and updated during every survey. Results of every individual were entered in an electronic data base and analyzed with SPSS (version 11, SPSS Inc., Chicago, Ill.). Results were expressed as a proportion (p) of the population sample studied (n); 95% confidence interval (95% CI) of the proportion was calculated with a correction for a finite total population (N) according to:

$$SE = \sqrt{p(1-p)/n} \cdot \sqrt{(N-n)/N}$$ \hspace{1cm} (95% CI = $p \pm 1.96 \cdot SE$)

The studied children were divided into three age groups: ≤ 5 years, 6 through 10 years, and 11 through 16 years. Chi-square test ($\chi^2$) was used to compare the rate of IHI in different surveys and different age groups. Statistical significance was accepted at a p-value <0.05.

RESULTS

During the first three surveys approximately 43.4%, 49.7% and 38% of all children returned the container with a fresh stool sample for examination respectively. In the last survey, when the rate of IHI had significantly dropped, only hundred twenty two fecal samples (23.5%) were collected. In all surveys, the response rate among children between 6 and 10 years was the highest (from 36.1% to 60.8%; Figure 1).

Before interventions, in the first survey of April 1997, 28.6% (95% CI: 24.1 to 33.2) of children excreted eggs of at least one parasite, hookworm being the most common (23.0%; 95% CI: 18.8 to 27.3) followed by Trichuris trichiura (1.9%; 0.5 to 3.2%), Hymenolepis nana (1.9%; 95% CI: 0.5 to 3.2), Enterobius vermicularis (0.9%; 95% CI: 0 to 1.9), Ascaris lumbricoides (0.5%; 95% CI: -0.2 to 1.2), and infection with multiple helminths infection (0.5%; 95% CI: -0.2 to 1.2). Strongyloides stercoralis was never found. Hookworm was almost always present in those infected with multiple helminths. The infection rate was significantly more prevalent in children aged 6 – 10 years than in other ages (data not given) in the first two surveys (figure 2). IHI was slightly more prevalent in girls compared to boys in the two first surveys but this difference did not reach statistical significance.
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**Figure 1:** The proportions of intestinal helminth infections in the children below 17 years in Phan Tien, in feces examination surveys from April 1997 to December 1999. *IHIs:* Intestinal Helminth Infections

As a result of the health education, people started boiling their drinking water and some families built a latrine at their compound. People increasingly used sandals and shoes, stimulated by the free distribution of sandals. In general, the sanitation in Phan Tien improved.

The quality of the albendazole drugs used in the first mass treatment campaign was checked when no reduction of IHI was observed in the second survey (26.6%; 95% CI: 22.7 to 30.6). The albendazole formulation was examined to its content by
standard analytical techniques including, high performance liquid chromatography (HPLC), by the department of Clinical Pharmacology in the Academic Medical Center in Amsterdam. It appeared that the albendazole tablets contained less than half of what it should be. In December 1997 65.7% of the entire population received albendazole from the other manufacturer and 51.4% in September 1998 (100% of all school children on both occasions). Hereafter the IHI rate declined rapidly, as is shown in Figure 1.

At the survey of November 1998 the IHI rate had decreased to 8.7% (95% CI: 5.6 to 11.8; p <0.0001) but the infection rate of H. nana remained stable at 6.2% (95%CI: 3.5 to 8.8) until praziquantel was given to infected subjects in December 1998. In December 1999 this decreased to 1.6% (95% CI: -0.3 to 3.6) in 1999. The overall IHI rate decreased to 3.3% (95% CI: 0.5 to 6.0) after three years of intervention ($\chi^2 = 20.81$, p < 0.0001).

DISCUSSION

A high prevalence of parasitic intestinal infections was found in children in Phan Tien, related to low standards of sanitation and walking barefoot. The highest prevalence of IHI was found in children from 6 to 10 years old, because they often play outside. Younger children are looked after more carefully by their parents and older children play less and may have more knowledge about personal hygiene.

Surprisingly, Ascaris lumbricoides, which is the most frequently found worm in other areas in Viet Nam (11) and worldwide,(12-15) was very rare in this population. This is probably explained by the habit of the ethnic minority population of Phan Tien of not cultivating vegetables which are usually eaten uncooked, such as lettuce, for uncooked eating raw, uncooked food and not using human excreta in agriculture.

After the first half year of interventions, the IHI prevalence had not changed. This rose suspicion of the quality of the albendazole tablets, made by a local pharmaceutical company. Although a compensatory increase during the rainy season could not be excluded -the first survey was performed at the end of the dry season and the second after the rainy season- we considered the ecological conditions in Phan Tien suitable for stable soil transmission of hookworms throughout the year. Moreover, it was confirmed that the tablets contained only half of the indicated dose and when another formulation was used, the IHI rate declined rapidly. Therefore we conclude that the lack of any effect on the prevalence of intestinal helminth infections was due a sub-therapeutic dose of albendazole.

Mass treatment is very important for a rapid elimination of intestinal helminth infections, while health education and sanitation play a role in preventing re-infection. A previous study in the north of Viet Nam was exemplary: after 5 years of intervention by health education and improving personal and environmental hygiene but without anthelminthic treatment, only a moderate decrease of A. lumbricoides and hookworm infections was observed.(16) In our study, mass treatment was not
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continued after the third survey in November 1998 but IHI rate did not increase in 1999. This is consistent with the preventive role of hygienic interventions. Therefore, we emphasize that mass treatment with albendazole is an essential tool for rapid reduction of intestinal helminth infections while other interventions such as health education, improvement of environmental sanitation and supplying safe water are necessary to prevent reinfection.

Albendazole is a broad-spectrum anthelmintic drug. Several community based trials have shown albendazole to be safe and effective in eradicating many parasites but the dosing regimens applied in mass treatment campaigns varied from a single 400mg dose to 2000 mg divided over five days, with consequently variable success rates. (17-21) In this study, the single 400 mg albendazole dose of the second formulation was highly effective whereas the first formulation was not. This shows that the success of mass treatment campaigns depends greatly on the quality of the used formulation. This is an important aspect to take into the total account of costs and efforts invested in the control of intestinal helminth infections.

Many previous studies showed that chemotherapy with broad-spectrum antihelminthic drugs is one of the most important strategies in helminthic control programs and both mass treatment and selective or targeted treatment after mass screening can be applied. (22-25) Selective or targeted treatment may be most effective for the control of morbidity if a highly exposed group can be identified. (26) However, it always requires mass screening first with expert medical staff, which is not available everywhere, particularly not in remote areas in developing countries. On the contrary, mass treatment can be guided by primary screening but it can also be based on extrapolating the results of helminthic surveys in similar communities. Furthermore, the advantage of mass treatment is that teachers, mothers or other non-health-professionals can distribute anthelmintic drugs efficiently to school age children with minimal training. (27;28) This saves time, human resources and finances. In this study we show that mass treatment, focusing on school children, is effective, even when the coverage among the entire population is between 50 and 60%.

Praziquantel at a dose of 50mg/kg of body weight (29) was effective in eliminating H. nana. In this study we administered praziquantel only to those subjects who were infected with H. nana but Nahmias et al. showed that combining a single dose of 400mg of albendazole and praziquantel (40mg/kg body weight) in their mass treatment campaigns eradicated approximately 85% of all intestinal helminth infections. (30) In that study the high rates of hymenolepiasis and schistosomiasis justified the use of praziquantel for mass treatment. The current price of an albendazole 400mg tablet is around US$ 0.20; a praziquantel 600 mg tablet costs around US$ 0.1. A combined regimen can be cost effective for deworming campaigns, without stool examination, especially in areas with multiple helminthic infections.
Nowadays the impact of intestinal helminth infections on human health, especially of children, is well recognized. The findings in this study are most likely representative of most other ethnic minority communes in the remote areas of Viet Nam. Because mass treatment of IHI with albendazole is cheap and can reduce IHI quickly in a short period of time, we suggest that this can be organized through the logistics of the malaria control program in Viet Nam which is free of charge to the vulnerable and poor populations.(1)

CONCLUSION

In an ethnic minority commune in a mountainous area in southern Viet Nam, a high prevalence of intestinal helminth infections was found. Interventions with repeated albendazole mass treatment, health education and improvement of environmental hygiene and supply of clean water were initially frustrated by poor quality of the albendazole formulation used. Replacement quickly led to a significant reduction of the IHI rate. This method can be used for other areas with similar conditions.
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