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# Public Health Measures in Trematode Control in Asia

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Human trematode infections are largely confined to the tropical and oriental Asian countries. The liver flukes(clonorchiasis, opisthorchiasis), lung flukes (paragonimiasis), blood flukes(schistosomiasis japonicum, schistosomiasis mekongi) and intestinal flukes (heterophydiasis, metagonimiasis, and fasciolopsiasis) in particular are responsible for major public health problems in certain Asian countries. These parasitic infections mediated by snails can produce an endemic focus. The habits of the human population not only are responsible for infections in endemic foci but also are frequently essential factors in propagating the disease.

In 1947 Stoll[1] estimated that liver, intestinal and lung flukes cause infection in about 34 million individuals. Updating that estimate is difficult but these infections are still fairly common. An estimation of these today is belived to be more than three times higher. About 60 different species of trematodes are infecting to 100 million people in Asia[2].

In the liver flukes, clonorchiasis occurs in China, Korea, Taiwan, Japan and Vietnam, and we estimates its infection about 30 million. Opisthorchiasis viverrini occurs in Northern Tailand and Laos and estimated 10 million[3,4].

In the lung flukes, paragonimiasis is caused by *Paragonimus westermani*, widely distributed in China, Korea, Japan, Thailand and Philippines. Other species are sometimes found in man in China, Japan, Thailand and the Philippines. There are an estimation with 10 million cases in Asia.

In the blood flukes, *Schistosoma japonicum* is highly endemic in many provinces of mainland China and in some islands of the Philippines. *S. mekongi* is responsible for infections in Laos, Cambodia and Thailand. It is now estimating about 20 million altogether[5].

In the intestinal flukes, fasciolopsiasis is present in Central and South China, Taiwan, India, Central Thailand, Laos, Cambodia, Bangladesh, Vietnam and Malaysia, with a total 10 million infected cases. Other numerous intestinal parasites, including *Metagonimus yokogawai, Heterophyes heterophyes* and echinostomes assume varying degrees of clinical significance according to the number of flukes harboured[6].

On the modes of trematode infections, clonorchiasis, opisthorchiasis, metagonimiasis, heterophydiasis and some *Echinostoma spp* infections are all fish-transmitted disease[7]. They are acquired by eating raw fish containing infectious metacercariae. This is often significantly related to human behavioural patterns based on socio-economic and cultural conditions and linked with the local biologic and physical environment.

Clonorchiasis in Korea, this fish-eating habit in rural areas is one of the deeply rooted traditional customs, and therefore hardly changeable among Korean people. As to opisthorchiasis, it is well known in Northeast Thailand that "Koi-Pla" is the most popular raw fish food among the villagers. Another

Table 1. Trematode infections of man in Asia

| Diseases | Distributions | Population(mil.) |
|---|---|---|
| Liver flukes : | | |
| *Clonorchiasis | China, Korea, Japan, Taiwan, northern Veitnam | 30 |
| *Opisthorchiasis | Northern Thailand, Laos | 10 |
| Fascioliasis (2) | Cosmopolitan (accidental) | |
| Lung flukes : | | |
| *Paragonimiasis (5) | China, Korea, Japan, Thailand, Philippines, Malaysia, India, Indonesia, Ceylon | 10 |
| Blood flukes : | | |
| *Schistosomiasis (2) | China, Japan, Thailand, Laos, Cambodia, Philippines | 20 |
| Intestinal flukes : | | |
| *Fasciolopsiasis | China(central & south), Laos, Taiwan, Cambodia, Thailand, India, Bangladesh, Vietnam | 10 |
| *Heterophyiasis | Philippines, China, Korea, Taiwan | 3 |
| *Metagonimiasis | China, Korea, Janpan, Taiwan, Philippines | 3 |
| Other heterophyids infections (23) | Japan, China, Korea, Philippines, Taiwan, Thailand, Indonesia | 1 |
| Echinostomiasis (15) | China, Japan, Korea, Thailand, Indonesia, Malaysia, Taiwan, Philippines, Celebes | 1 |
| Gastrodisciasis | India, Burma, Malaysia, Vietnam, Thailand | |
| Spelotremiasis | Philippines | |
| Plagiorchids inf. (1) | Thailand, Philippines, Japan, Indonesia | |
| Lecithodendrids inf. (2) | Thailand, Indonesia | |
| Fibricoliasis | Korea | |

important factor responsible for the increase of infection is the complete lack of latrines in villages, especially in endemic areas.

The most important method of infecting man with *Paragonimus* is undoubtedly eating raw or uncooked crabs or crayfish. Particularly Korean people in endemic areas are fond of eating fresh-water crabs immersed in soy bean sauce (Geh-Jang). Raw crayfish usually is not eaten by Koreans. However, children often eat such crayfish which are caught by them in streams on their route to and from school.

On the other hand the most frequent way to get fasciolopsiasis is by ingestion of raw water plants (i.e. water caltrops, water hyacinth, water chestnut etc.) cultivated in endemic areas where they are fertilized by human excrements thrown into the water at night[8]. On the contrary, schistosme infections occur by exposure to the cerecariae which bore into the skin in infected water.

All of these trematode infections are parasitic zoonoses to man and animals, and domestic animals such as dog, cat, pig, as well as rat and some mam-

Table 2. Sources of infection and reservoir hosts in trematode infections

| Diseases | Sources of infection | Reservoir hosts |
|---|---|---|
| Clonorchiasis | freshwater fish | dog, cat, pig, rat |
| Opisthorchiasis | freshwater fish | dog, cat, pig, rat, fish-eating mammals |
| Paragonimiasis | freshwater crabs and crayfish | dog, cat, field rat |
| Schistosomiasis | in water | dog, cat, field rat, horse, ruminants |
| Fasciolopsiasis | water plants (water caltrops, watercress) | dog, pig |
| Heterophyiasis | freshwater fish and brackishwater fish | dog, cat, rat, fox, bird, weasel, mammals |
| Metagonimiasis | freshwater fish | dog, cat, pig |
| Echinostomiasis | Fish, loach, snail, clam, tadpole, frog | dog, pig, rat, mouse, bird, duck |

mals, ruminants and birds are act as reservoir hosts.

However, control of those infection is theoretically very simple, as the infection can only invade the human body in the form of encysted metacercariae when intermediate hosts are eaten. By contrast, it is far more difficult to take prophylactic measures in the case of schistosomiasis where cercarial larvae penetrate through the skin already in contact with contaminated water.

Thus, except for schistosomiasis, the most practical method of preventing human trematode infections is to avoid eating raw, freshly pickled, or imperfectly cooked fresh-water fish, crayfish or crabs, etc.

However, it is exceedingly difficult to carry out such simple measures in face of century old traditions, to which a relatively primitive population clings with great tenacity. Therefore in areas where it is customary to eat fish or crabs, educational propaganda stressing the importance of thoroughly cooking all fresh-water fish or crabs appears to be the most effective means of preventing such diseases[9].

There are a number of public health measures that could contribute to the prevention and control of trematode infections. These measures include the reduction of the sources of infection by chemotherapy, the control of snail hosts, the provision of satisfactory sanitary facilities and water supply, the health education, the promotion of diagnostic techniques, the environmental management and modification etc. However, the chemotherapy of infected individuals has been shown to a rapid and effective method of control.

The most important change in the control of trematode infections have been with the development of new drug such as praziquantel. Praziquantel is now the most favoured drug against all species of schistosomes, liver flukes, lung flukes, and intestinal flukes pathogenic to man[10].

Where the trematode diseases constitute an important health problem, the prevention and control programme must have both short-and long-term components. Eradication of trematode infections is not a realistic goal in most communities and countries at the present time.

Therefore, objectives of short-term measure are reduce mortality and morbidity, and those of long-term are reduce prevalence and intensity[11].

In the strategies in a short-term, as a "Disease-specific tools" are individual medical care for severely infested cases, and population-based chemotherapy in endemic areas. In the highly endemic areas of schistosomiasis, the application of molluscacides at periodic intervals is necessary. However, among these population-based chemotherapy is an important form of the control of trematode infections.

This can reduce the mortality and morbidity. For the implementation, community participation, drug delivery in coordination with primary health care and promotion of diagnostic techniques are the essential elements for the success in control measures. In a certain highly endemic areas, sanitiary excreta disposal and the education in use of latrine shouold be combined with the population-based chemotherapy[12].

Table 3. Efficacy of praziquantel against trematode infections (after Wegner 1984)

| Parasites | Dosages (total dose) (time × mg/kg × day) | Cure rate(%) |
|---|---|---|
| Liver fluke infections : | | |
| *Clonorchis sinensis* | 3 × 25 × 1d (75) | 68.8 ~ 95.7 |
| *Opisthorchis viverrini* | 3 × 25 × 1d (75) | 96.0 ~ 100 |
| *Opisthorchis felineus* | 3 × 25 × 1d (75) | 100.0 |
| Lung fluke infections : | | |
| *Paragonimus westermani* | 3 × 25 × 1d (75) | 80.5 |
| | 3 × 25 × 2d (150) | 91.4 |
| *P. heterotremus* | 3 × 25 × 1d (75) | 76.9 |
| | 3 × 25 × 2d (150) | 100.0 |
| *P. uterobilateralis* | 3 × 25 × 2d (150) | 100.0 |
| *Paragonimus sp.* in Ecuador | 3 × 25 × 1d (75) | 100.0 |
| | 3 × 25 × 2d (150) | 100.0 |
| Schistosomiasis : | | |
| *Schistosoma japonicum* | 1 × 40 × 1d (40) | 85.7 |
| | 2 × 30 × 1d (60) | 89.6 |
| *S. haematobium* | 1 × 40 × 1d (40) | 85.3 |
| | 2 × 20 × 1d (60) | 96.7 |
| *S. mansoni* | 1 × 40 × 1d (40) | 63.3 |
| | 2 × 20 × 1d (60) | 97.1 |
| *S. intercalatum* | 1 × 40 × 1d (40) | 89.3 |
| | 2 × 20 × 1d (60) | 84.2 |
| Intestinal trematodiases : | | |
| *Fasciolopsis buski* | 1 × 15 (15) | 100.0 |
| | 1 × 25 (25) | 100.0 |
| *Metagonimus yokogawai* | 1 × 10 (10) | 90.0 |
| | 1 × 20 (20) | 88.0 |
| *Fibricola seoulensis* | 1 × 20 (20) | 100.0 |

The strategies in a long-term control measures as a "Non-specific tools" are improvement of sanitation, continuing health education for changing food habits, hygienic measures such as safe water, washing hands, food safety etc. For this implementation, epidemiological surveillance, health education and community involvements are the most important elements in the control programmes.

Snail control by biological and alteration of the environment, environmental management and modification, and provision of satisfatory sanitary facilities are also necessary for these control measures. Among these, the most important preventive measures is the health education of people in endemic areas regarding the life cycle of the parasite, the mode of transmission, and the most practical measures of protection, given the particular cultural aspect of an area.

For instances, in Thailand, study on the control of opisthorchiasis through community participation conducted by Dr. Sornmani used the folk songs on tapes with lyrics promoting anti-liver fluke practices

Table 4. The control of trematode infections

| | Short-term "Disease-sepecific tools" | Long-term "Non-specific tools" |
|---|---|---|
| Objectives | Reduce mortality and morbidity | Reduce prevalence and intensity |
| Strategies | Individual medical care | Improve sanitation |
| | Population-based chemotherapy | Health education |
| | Snail control(in schistosomiass) | Non-specific hygienic measures (safe water, washing hands, food safety etc.) |
| Implementation | Community participation | Epidemiological surveillance |
| | Drug delivery | Health education |
| | Coordination with primary health care | Community involvement |
| | Promotion of diagnostic technique | Snail control by biological and alteration of the environment |
| | Sanitary excreta disposal | Environmental control (management and modification) |
| | Education in use of latrine | Provision of satisfactory sanitary facilities |

and abstention from eating raw fish[13].

Educational process should involves various levels to change successively knowledge, attitudes, behaviour, habits and customs of their lives. The choice of methods must be dictated by the nature of the environment, the habits and customs of the people, the pattern of transmission and the resources of the conuntry. There must exist a well organized public health infrastructure. It is necessary to develop control programs on a long-term basis and it is further essential to ascertain continuity for the consolidation of initially achieved results.

Therefore, conclusively, a combination of efforts with major emphasis on population-based chemotherapy with praziquantel and health education coupled with governmental aid in enforcing public health measures will certainly reduce these infections.

## 亞細亞에 있어서 吸蟲類感染 防禦를 위한 公衆保健學的 措置

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사람의 吸蟲類感染은 大部分 熱帶 및 東部亞細亞地域 여러 國家에서 發生한다. 住血吸蟲症, 肝吸蟲症, 泰國肝吸蟲症, 肺吸蟲症, 요꼬가와吸蟲症, 異型異型吸蟲症 및 肺大吸蟲症등은 어떤 一部 亞細亞國家에 있어서 公衆保健上 重要한 問題가 되어 있다. 이와 같은 貝類媒介性寄生蟲感染은 風土病을 일으키고 있다. 사람들의 생활습관은 풍토병을 일으키게될 원인이 될 뿐만 아니라 때로는 그 疾病을 流行 傳播시키는 기본적요소가 되기도 한다.

주혈흡충을 제외한 흡충류감염은 우리가 中間宿主를 먹었을때 그곳에 있었던 被囊幼蟲에 의하여 감염이 이루어 진다. 植物의 生殖(肝蛭, 肺大吸蟲), 게 및 가재 생식(폐흡충), 민물고기 생식(간흡충, 요꼬가와흡충, 이형이형흡충), 또는 우렁이 생식(棘口吸蟲), 기타(몇가지 偶然的感染)등은 사람의 흡충류감염의 주 원인이 되는 것이다. 한편 주혈흡충감염은 汚染水源에 접촉한 피부를 뚫고 들어온 셀카리아 幼蟲에 노출되기 때문에 일어난다.

흡충류감염에 대하여 예방과 방어에 관한 공중보건학적 조치는 많다. 이들의 조치중에는 화학요법에의한 감염원을 감소시키는 것, 패류숙주의 박멸, 만족할만한 위생시설의 비치, 급수시설, 보건교육, 진단기술의 보급, 환경관리 및 개선등이 포함된다. 그러나 감염자들에 대한 화학요법은 가장 빠르고 효과적인 억제방법인것으로 나타나고 있다.

흡충류감염을 예방하는데 있어서 가장 중요한 변화는 프라지콴텔과 같은 신약의 개발이었다. 프라지콴텔은 모든 종류의 주혈흡충, 간흡충, 폐흡충 및

여러가지 장내기생 흡충류등 사람의 병원성흡충류에 대한 치료제로서 가장 좋은 특효약이다.

흡충류감염이 중요한 보건문제가 되어 있는 곳에서는 그 예방과 억제책에 있어서 長短期計劃을 수립하는것이 좋을것 같다.

단기는 집단화학요법을 조기에 실시하여야 하고 장기는 "비특이성기구"로써, 예를들면 위생시설 및 급수시설의 설치, 보건교육등으로 감염을 감소시켜 감염유지 수준이하로 保持시키는 것이다.

이와같은 억제조치를 착실히 수행하기위하여 많은 일이 있다. 예를 들면 집단참여, 역학적조사, 약물의 공급, 환경관리, 보건교육, 지역사회관련, 일차보건진료와의 협조 및 재정후원등에 대하여 검토하고 연구하여야 할것이다.

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