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Epidemiology and control of schistosomiasis

Report of a WHO
Expert Committee

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AND CONTROL OF SCHISTOSOMIASIS**

Geneva, 6-10 November 1978

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EPIDEMIOLOGY AND CONTROL OF SCHISTOSOMIASIS

Report of a WHO Expert Committee

A WHO Expert Committee on Epidemiology and Control of Schistosomiasis met in Geneva from 6 to 10 November 1978. Dr I. D. Ladnyi, Assistant Director-General opened the meeting on behalf of the Director-General.

INTRODUCTION

Since the meeting of the WHO Expert Committee on Schistosomiasis Control in 1972 (1), many important advances have been made in the control of this disease. In recent years there has been a marked movement towards an integrated approach to control. There is now less reliance on single control techniques such as mollusciciding, much used in the past, and this has followed the development of improved chemotherapeutic drugs and the realization of the preventive value of the installation of domestic water supplies in endemic areas. Current integrated control methods employ all the available forms of chemotherapy, the latest mollusciciding techniques, methods to meet basic health needs such as the supply of potable water at village level and the provision of sanitation, as well as continuing health education and socioeconomic improvement.

The moves towards an integrated approach to control depend essentially on an accurate ecological assessment—of the human community and its parasitological characteristics, of the biology of the snail intermediate hosts, and of the physical and geographical characteristics of the environment. Man's behavioural attitudes and customs are being given increasingly greater attention because it has been realized that they may play a crucial role in the success or failure of a control programme.

Reliable and effective schistosomiasis control measures have now become available but the most suitable combinations of these measures, applicable in different habitats and under various conditions of schistosomiasis transmission, still need to be worked out. Further studies on the ways of ensuring community participation in control activities are also needed.

Control may be subdivided into disease control in the human population and transmission control of the biological cycle. Both are essential to the concept of total control of schistosomiasis.

The advances in chemotherapy during the past 10 years make it clear that drug treatment will play an increasingly important role in both disease control and transmission control. However, there is a need for much operational research in order to define the best ways of using the available drugs.

In these changing circumstances it is essential to know to what extent the control measures against schistosomiasis can be integrated into the general health services and particularly those at the primary health care level. It is also necessary to ascertain which of the highly specialized biological techniques involving bionomics and control of the intermediate hosts can be taught to health auxiliaries. It appears that the present shortage of skilled personnel in communicable diseases control will continue for some years.

An increase, sometimes marked, in the prevalence of infection frequently occurs in association with different water resources development schemes. The creation of man-made lakes, and the introduction of new irrigation schemes or the extension of existing ones in endemic areas or in areas adjacent to existing transmission foci, are significant factors in the spread of the infection. This highlights the importance of planning for prevention and control not only of schistosomiasis but also of other communicable water-related diseases in such schemes. Inadequate planning may result in the spread of the infection, and this may nullify some of the planned economic benefits owing to the increased costs of control.

1. EPIDEMIOLOGY

The control of schistosomiasis depends on a profound understanding of the epidemiology of the disease complex, and in particular of the biology, ecology, and distribution of the parasites, their snail intermediate hosts and mammalian reservoir hosts. A sound knowledge of the role of man in transmitting and maintaining the infection is also important. Moreover, the ultimate success of any control programme is dependent upon a full comprehension of the local socioeconomic conditions and upon the appreciation by the health authorities of the benefits of the proposed measures to the population living in the endemic areas.

In view of the considerable recent advances in all aspects of the epidemiology of schistosomiasis, it appears desirable to review the present status of our knowledge in order to reformulate our strategy for control.

1.1 The parasite

1.1.1 *Schistosome taxonomy and physiology*

Efforts to delimit schistosome species and to understand further the interrelationships that exist between species have been directed towards studies of the egg and cercarial and adult stages of the parasite. Human cases of "terminal-spined-egg" schistosomiasis, due to infection with *Schistosoma haematobium* or *S. intercalatum*, may be distinguished relatively easily on the basis of differences in the egg excretion pattern in urine and stool, the clinical symptoms, and, above all, the length/frequency curves of the eggs (2, 3). It is more difficult, however, to distinguish *S. intercalatum* from *S. matthei* on the basis of egg morphology since the eggs of these two species are similar in size, though slightly different in shape (4). Differential staining techniques (Ziehl-Neelsen) appear to be of some use in distinguishing the eggs of *S. intercalatum* from those of *S. matthei* and *S. haematobium* in tissue sections (5, 6, 7).

The specific identification of cercariae may be of some practical interest in epidemiological surveys and several techniques have been developed for this purpose. The most frequently used technique is the enumeration and distribution of the argentophilic papillae. Several studies indicate that the number and distribution pattern of these presumably sensory organs on the cercarial body are relatively constant within one species and sufficiently different from those in other species to be taken as characteristic. Employing this technique, it has been possible to separate clearly cercariae of the *mansoni-rodhaini* group from those of the *haematobium-bovis* group (8), and a clear difference has been found between cercariae of *S. rodhaini* from Kenya and those of *S. mansoni* from Kenya and Brazil (9). The use of histochemical techniques has further demonstrated differences in the pre- and postacetabular glands of *S. mansoni* and *S. haematobium*, on the one hand, and *S. japonicum*, on the other (10). Isoenzyme techniques also show promise in differentiating cercariae,

particularly in distinguishing *S. haematobium* from *S. matthei* (11, 12).

Hybridization of adult worms in the definitive host and its implications on both the taxonomy of the various species and their transmission is of considerable interest and importance. Data supporting the hybridization of *S. matthei* and *S. haematobium* and of *S. intercalatum* and *S. haematobium* have given rise to speculations concerning the nature of these forms as "true" species. At present no information exists on the hybridization of *S. japonicum* strains, except, perhaps, for a possible hybrid between *S. japonicum* and *S. incognitum* in parts of Indonesia where the two parasite species are sympatric not only in geographical area but also in definitive hosts.

Recent data from Ghana suggest that two strains of *S. haematobium* formerly utilizing either *Bulinus truncatus rohlfsi* or *B. globosus* as intermediate hosts may have hybridized and that *B. t. rohlfsi* in Lake Volta may be able to transmit both these strains. Similarly, the spread of *S. intercalatum*, one strain of which normally utilizes only snails of the *B. forskalii* group, may now be adapting to the snails of the *B. africanus* group as a consequence of hybridization. An increase in the susceptibility of *Biomphalaria tenagophila*, noted recently, suggests that hybridization may be occurring in the Brazilian strains of *S. mansoni*.

The role of hybridization of parasite strains with respect to the response of the resultant hybrids to chemotherapeutic agents has not been adequately studied.

1.1.2 Relation between intermediate snail hosts and parasites

Although early studies on snail host-parasite relationships indicated relatively direct and uncomplicated interactions, recent observations on the interrelationships between many species and strains of *Schistosoma* and their actual or potential snail hosts have demonstrated a remarkable degree of variation in infection rates, duration of infection, cercarial production, and snail mortality due to infection.

In the early studies emphasis was placed on the varying susceptibility of the snail species, but later it became clear that schistosome infectivity was equally important. Recent research has confirmed this reciprocal approach, but because of the lack of standardized materials and methodologies, valid comparison of data has seldom

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