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BILHARZIASIS AND ITS CONTROL

BILHARZIASIS CONTROL PROBLEMS IN IRAQ

by

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I HISTORICAL BACKGROUND

The antiquity of bilharziasis is well known. The history of haematuria predates the discovery by Bilharz in 1851 of the adult worms and the establishment of their role in the passage of blood in the urine. Until 1899 it was believed that urinary bilharziasis was confined to Africa and its coastal islands. In that year Sturrock contradicted this statement which was made in the 1898 edition of Manson's textbook of Tropical Diseases, saying that he had observed the signs of vesical bilharziasis in the Tigris and Euphrates valleys from Basra to 900 miles north, and it was particularly prevalent north of Baghdad. He also mentioned that it was notably lacking in those areas bordering the Shatt El Arab where the tidal effects of the Persian Gulf are felt. This constitutes the first report of bilharziasis in Iraq, and the basis for the long held but now questioned belief that the tides are responsible for its non-occurrence south of Basra.

The controversy regarding the possible role of the snail in the transmission of the disease was an important parasitological question during the first part of this century and demanded the efforts of many research workers. Such eminent parasitologists as Looss failed to obtain evidence that there was an intra-molluscan phase of the parasite. It was not until the experimental work of Fuginami (1909), Miyagawa (1913), and Miyairi and Suzuki (1914)

in Japan that the life cycle of S. japonicum was elucidated and the role of the snail in transmission definitely established. These publications formed the basis for Leiper's work in Egypt (1915 - 1918), confirming that the snail is necessary for the completion of the life history of the parasite, and that two species of schistosomes were involved in Egypt.

The next reference to the disease in Iraq was made by Boulenger (1919), who not only investigated an outbreak of urinary bilharziasis in an Indian general hospital in Basra but also made a malacological and urinary survey in selected areas of the country. In the examination of the urine of 174 adult males, 20% were found to harbour haematobium eggs. It is a surprising fact that several reports published since, and based on more numerous examinations, have also indicated the 20% infection rate. The role of Bulinus in the transmission of urinary bilharziasis was known to Boulenger but although he made an extensive search he did not find any living snails of this genus.

Sinderson and Mills (1923) published a paper on rectal papillomata in haematobium infections. Hall (1925) investigated various incidences of the disease from Hindiya to Basra. Neveu-Lemaire (1928) reported on human infections based on reports of the Iraq Health Service. Sinderson (1930) described anomaly pigmentation in bilharziasis. MacHattie and Chadwick (1932), and MacHattie, Mills, and Chadwick (1933) according to their publications on Schistosoma bovis in Iraq, considered S. matheei indistinguishable from bovis. Norman (1935) produced an X-ray photo of a case of urinary bilharziasis. MacHattie (1936) reported S. turkestanicum in livestock of the southern areas of the country, and established Lymnaea as intermediate host.

Mills, MacHattie, and Chadwick (1936) worked out the life cycle of S. haematobium in Iraq and firmly established the role of Bulinus in transmission. In an examination of over 10,000 Lymnaea, they also found that this snail is not a factor in human urinary bilharziasis.

Watson (1948-1958), mostly alone but in some cases with other authors, has published over a dozen papers on both the human and snail side of bilharziasis in Iraq. The most recent and most lengthy paper is on the ecology of Bulinus in the Middle East.

Helmy (1951), and Azim and Gismann (1956) have reported on both human and snail bilharziasis surveys in Iraq. Aspects of the ecology of Bulinus are discussed in a publication by Zakaria (1954, 1955) who also wrote a thesis (1955, unpublished) on bilharziasis in Iraq. Wajdi (1955) wrote a paper on populations of Bulinus in the winter season, but the reliability of the figures and his statements must be doubted, because of the lack of field supervision during the study. The use of two cercarial antigens in bilharziasis skin test trials in Iraq indicate the non-specificity of the resulting reaction, according to Azzawi and Klimt (1958).

The Endemic Diseases Institute of the Ministry of Health, which was formerly the Endemic Diseases Department of the Republic Hospital, was established in 1949. The general line of work of the Bilharziasis Section of the Endemic Diseases Institute has been human urine examinations and the treatment with copper sulphate of canals harbouring Bulinus. The WHO Bilharziasis Control Project began operations in 1955 with varying numbers of national and international staff since that time. In addition to the published results of the skin test trials mentioned above, there exists a series of unpublished documents by this group which has to do with the project area in Tarmiya, environmental aspects of rural habitation, proposed water treatment plant for communities in rural areas, comparative therapeutic trials of Stibophen and Miracil D, study of water flow in earth canals, treatment of urinary bilharziasis with reduced dose of Miracil D, endemicity studies on bilharziasis in the vicinity of Basra, and random sampling survey of bilharziasis in the Tarmiya Project Area.

II THE CONTROL PROBLEMS

1. Geographical extent and regionalization

Generally speaking, the distribution of the snail host and the existence of human infections in various parts of the country are fairly well known, but quantitative information is usually unreliable. We know bilharziasis to be endemic in Iraq from South of Mosul, Erbil and Kirkuk along the principal rivers, the Tigris, the lesser and the greater Zab and the Diyala and the areas irrigated by them, the upper reaches of the Euphrates through all Central Iraq,

the Mesopotamian plain to the marsh areas of the South, the Muntafiq and Amara provinces as far as Basra City. Here endemicity suddenly disappears and leaves the riverain districts of the Shatt El Arab between Basra and Fao and the Persian Gulf free of the disease.

There are several questions, however, which need to be answered. Why is the disease abundantly present in Basra and completely absent south of the city? What are the factors involved in areas such as Nasiriya and Lake Hammar, where high human infection is so easily demonstrated and Bulinus can be demonstrated only with difficulty if at all? Why are there settlements in the marsh area where bilharziasis appears ubiquitous while others with apparently similar environment only have imported cases? How reliable are estimates of the geographical extent of the disease when based only on questions concerning haematuria? - It is obvious that significant information can be gained regarding these questions only from reliable studies on the definitive and the intermediate host.

2. Possible extension through irrigation and resettlement projects

There has been and will doubtless continue to be in Iraq considerable activity with respect to extending irrigation and the resettlement of the reclaimed areas. In half a generation perhaps one sixth of the arable land of Iraq will have been reclaimed and hundreds of thousands of new settlers will till the soil. Will they also be subject as the majority of the present fellaheen are to the scourge of bilharziasis? Recent experience has been ominous. Active transmission is already taking place in areas like Latafiah, only four years under cultivation, while prevalence in the Tarmiah area, ten years under extended irrigation, is estimated at 34% for all its population.

With only recent exceptions, there has been little communication between irrigation and resettlement specialists and health authorities. One can see the potential turn of events if this situation remains as it is. When new irrigation systems are created or old ones extended the opportunity arises for snails to populate new areas. Many individuals who take up their new abodes are active cases of bilharziasis (twenty per cent in our experience at Muzayeb irrigation project), and this in spite of a regulation requiring a medical

certificate of freedom from infective diseases, although as yet no snail hosts have been found in the area. Thus man creates the conditions for new potential endemic areas, and although the new irrigation project is executed with the idea of human improvement, through ignorance or neglect a human problem is created.

3. Social factors, systems of land tenure and irrigation

Certain social and economic factors are obstacles to bilharziasis control in Iraq. The more important ones may be summarized as follows:

(a) The present system of land tenure provides for only a very small fraction of small land owners who could be called upon to take local responsibilities or to shoulder expenditures. In Iraq only 40% of the land is privately owned and managed, while the remainder is rented either from private owners or the public estate.

(b) The present system of canal ownership and management does not permit the organization of a centrally directed control campaign. Except for the recent governmental irrigation projects, canals are private property. They have mostly been dug without sufficient engineering help in a haphazard fashion, are usually directly connected with the river and do not form systems of principal, branch and lateral canals. Thus not only is the number of the canals uncontrollable, but responsibility for them is divided between as many or more owners.

(c) The present system of land rotation at the direction of the large landowner dislocates villages periodically and makes it impossible to provide adequate sanitary facilities. The land rotation system to restore natural fertility if used within small holdings does not necessitate moving the village, but within large holdings such rotation makes changing of the village site inevitable.

(d) The present system of tribal organization concentrates powers of decision in too few hands - powers almost feudal in their extent - and not infrequently abuses occur and the material advantage of the sheikhs is considered before the social welfare of the people.

The above problems prevail throughout most of the land at present under cultivation, but once the ambitious programme of resettlement in newly irrigated land is completed it is expected that about one sixth of the land under cultivation will belong to the new governmental reclamation projects. In these areas the problems are of a different nature. The first concerns the maintenance of agricultural productivity which is continuously endangered by the deposition of salt from subsoil sources. Scientific irrigation and, most important of all, drainage systems which are at present only provided in one project of Iraq, the Greater Musayeb, should solve this age-old problem. The second problem is of a social nature. Land, although potentially fertile, is insufficient to attract settlers. The provision of an attractive environment including the protection of health through medical care and sanitation, plays an important role. Coordinated planning between the engineers and the social services is a requirement for ultimate success which has not yet been fully realized.

4. Economy and Finance

Iraq's hope for development and for raising the living standards lies in the field of agriculture as, apart from oil, no great mineral resources have so far been discovered. The improvement of agricultural techniques and the expansion of arable land by irrigation, drainage and flood control are therefore of overriding importance. The people of Iraq have recognized this and have spent over the past ten years seventy per cent of the oil income averaging about 200 million dollars per year on various long term development projects. If investment on such a scale could be continued for another twenty years the basis should be laid for the maintenance of high living standards even without added income from oil.

At present the annual income of rural inhabitants in Iraq is estimated at Iraqi Dinars 35 (1 Iraqi Dinar = 1 Pound Sterling). Thus little can be expected from them to cover the costs of medical care and preventive measures.

Direct measurement of economic loss due to bilharziasis is difficult, as the average duration of total incapacity, the degree of partial incapacity and treatment costs, are unknown. We may count as a minimum the loss of the equivalent of twelve days' activity for every treatment course, as distances

to dispensaries where injections are given are generally great, sometimes requiring an entire day to get one injection of stibophen.

The national expenditure for bilharziasis control work amounted to Iraqi Dinars 54,000 during the fiscal year 1957/58 out of which about I.D. 6,000 were spent on the WHO Bilharziasis Control Project in addition to $ 30,000 US contributed by the World Health Organization. Apart from personnel expenses the greatest single item is the cost of molluscicidal chemicals, copper sulphate at about I.D. 100 per ton and sodium pentachlorophenate ranging between I.D. 200 and 240 per ton according to whether delivered in powdered form, in pellets or briquets.

The cost of molluscicidal operations has been worked out on a pilot scale for different methods of treatment with either copper sulphate or NaPCP. It transpires that copper sulphate applied three times a year at 20ppm or once every three years at 30ppm and continuously at 0.15ppm costs I.D. 0.72 per capita per annum, I.D. 0.70 respectively for the chemical barrier. NaPCP given twice a year at 15ppm comes to only I.D. 0.24 per capita per annum. This is due mostly to greater efficiency but also to reduced labour requirements, as for canals of average length a single application at the intake is sufficient, while $CuSO_4$ needs to be distributed by hand over the entire length of the canal.

5. Recruitment and Training

In Iraq as in most countries where bilharziasis is endemic, a great shortage of medical zoologists or malacologists exists and it is to be regretted that most graduates of zoology from the Baghdad College of Science are attracted to laboratory posts in hospitals and many change their professional objectives as a result of military service. The authorities should be urged to create sufficiently remunerative posts to attract national malacologists with the possibility of further training by the WHO medical zoologist and later through WHO fellowships. Adequate training could be obtained in a post-graduate course of two years' duration at the museum of Natural History in Michigan, U.S.A.

Most physicians in Iraq are oriented towards clinical medicine and it is difficult to find sufficient numbers willing to make public health their career. Frequent shifting of physicians in the state service both with regard to type of work and to geographical location does not help in the development of a career in one field. The necessity for maintaining a private practice in order to make a living makes it difficult for full time public health physicians. It is desirable that allowances should be created to compensate them for losses incurred through the closing of their private clinics. Specialized training in public health through courses taken abroad may create interest, but by itself it is not usually enough to keep a physician in the field once he has returned to his home country.

Sanitary engineers are few in Iraq and their functions within the Ministry of Health are not yet fully defined. Recruitment should start during the training for civil engineering and adequately remunerative posts should be created for them with the provincial health administrations as well as with the major municipalities. In the field of bilharziasis control there is a definite need for them and special training in irrigation would be desirable.

Laboratory technicians are also scarce and no new graduates are being trained since the discontinuation of the school that was jointly operated by US ICA/Iraq and the Endemic Diseases Institute until 1957. Those there are have a widely varying background of training to the detriment of unified procedures.

Multi-purpose endemic diseases control workers could be trained by extension of the training course given at present through the Training Section of the Endemic Diseases Institute to malaria eradication workers. The new specialties involved would be available from the WHO bilharziasis control project and from the newly created hookworm control section. Special training in the handling of NaPCP could be given by experts supplied by the manufacturers.

Public health nurses are entirely lacking in Iraq and proposals for recruitment and training must come from public health policy-making sources. Progress could perhaps be made in the beginning by sending suitable candidates from the general nursing profession to be trained at the Higher Institute of Nursing, Alexandria.

Teacher training courses in prevention of endemic diseases, hygiene and sanitation, should be offered in the form of short courses perhaps of one week duration during the summer holidays. Such courses could best be organized within the framework of the Endemic Diseases Institute in Baghdad and teachers should be offered allowances for the duration of the courses.

6. The Bilharzia Control Law

The "Law of Bilharzia Control and its Snail Vector" was passed as law No. 38 in 1952. Its main drawbacks are its overenthusiastic requirements which cannot be implemented with facilities available at present. Compulsory examination of everyone living in an endemic area is required within a six-month period; with an estimated three million people, the treatment of everyone found infected, might involve one million persons. It also puts the onus of transportation to and from the clinic on the health authorities, which would have to bring every patient twelve times for his injections of stibophen or fuadin. Little wonder that the law has never come into force except in Baghdad Liwa and even there it has not been successfully applied.

The regulations regarding closure of canals for purposes of chemical or mechanical vector control and the right of health officers to inspect any land during the day-time are well formulated, but experience has shown that they are not enforceable as long as property rights extend to irrigation canals. In future, penalties imposed under Article 12 should either be increased or better, a governmental agency with authority for canal management should be set up, to extend both to canals owned by the public and by private persons.

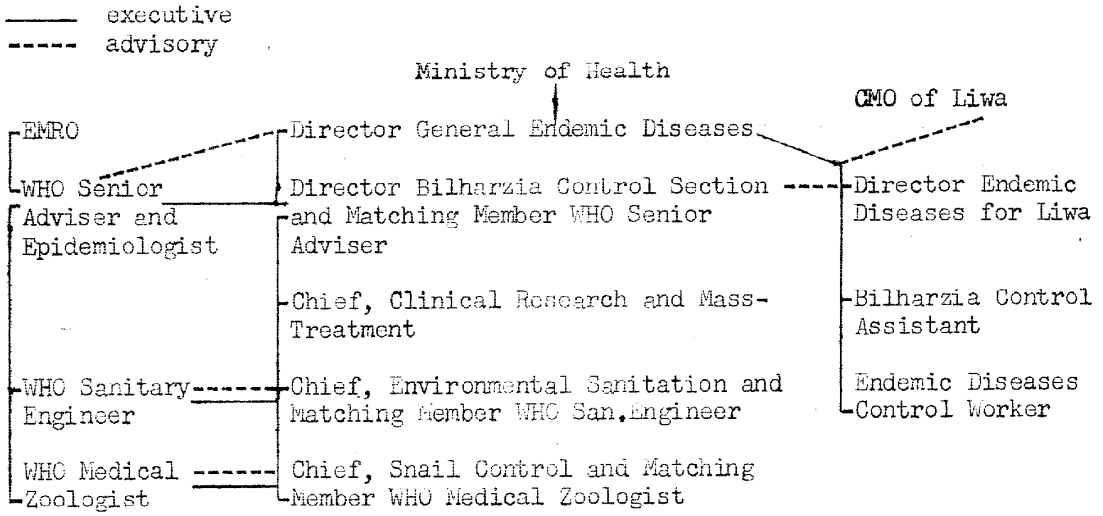
7. Administration and Organization

Shortcomings in the administrative organization of bilharziasis control have so far been twofold: The National Bilharziasis Control Section was responsible for control operations of a routine nature throughout Iraq, while the WHO Bilharziasis Control Project was engaged in research and pilot operations.

The Bilharziasis Section lacked personnel at headquarters level, and in particular, specialists in epidemiology and sanitary engineering, medical clinicians and fully trained medical zoologists, while its field organization, though widespread, was short of well trained and permanently employed workers. The WHO project on the other hand had the complementary technical services at headquarters.

Recently a reorganization programme has begun. Its main features are illustrated in the chart below and subsequently described:

Reorganization of Bilharziasis services



The three main points of the reorganization programme are the following:

(a) The national counterpart of the WHO Senior Adviser will be director of the Bilharziasis Control Section. The chief clinician, the sanitary engineer and the medical zoologist, will be executive officers in the Bilharziasis Control Section, in addition to their role in the WHO project. The proposed combination of two functions of leading national personnel would assure coordination of activities between the WHO-assisted Bilharziasis Project and the Bilharziasis Section and lead to the ready adoption of new techniques developed at the project on a country-wide scale.

(b) The appointment of a Director of Endemic Diseases in every Liwa (province), extending the present system of regional directorships in Baghdad, Mosul, Kirkuk and Basra. Under him and with the technical guidance of specialized assistants, multi-purpose endemic diseases control field personnel would work for malaria, bilharziasis and hookworm control as well as general rural sanitation in accordance with seasonal requirements.

(c) The conversion of malaria eradication workers, by training to endemic diseases control workers, including molluscicidal and canal clearance operations as well as rural sanitation. Instead of their present seasonal employment they would then be continuously employed. In this way it is hoped that a career could be assured to the malaria worker and that at the same time a strong field organization of multi-purpose endemic diseases

control field assistants would be built up. A further advantage would be to reduce the need for seasonal hiring and training of newly employed workers and to give them stability and pride in their work.

6. Technical

(a) Mass treatment: There are problems connected with both oral and parenteral therapy. All drugs available so far cause toxic side reactions not infrequently of a severe nature. Technical skill is required for parenteral injections and medical supervision for immediate treatment of side reactions and cessation of further specific therapy. The WHO project in Iraq has conducted controlled experiments in Baghdad prison as a result of which mass treatment by mouth with Miracil D in reduced dosage is recommended for rural areas where otherwise no treatment could be offered for lack of medical supervision. For this purpose a dose of 60mgm Miracil D per kilogram bodyweight distributed evenly over a period of ten days is found suitable. It is anticipated that during such mass treatment campaigns, which will have to be repeated annually, macroscopic haematuria alone may have to be relied on for diagnosis.

(b) Snail control by chemicals: The problems here are with cost, personnel and handling, especially if NaPCP is to be used. Cost as a factor has been dealt with already under the heading "Economy and Finance", from which it is concluded that NaPCP may only cost one third of a correspondingly efficient application of copper sulphate, e.g. about one quarter of a dinar per year per person protected. Nevertheless overall costs would be prohibitive, particularly if one considers the need for its continuous application with the possible hope of eradication of the snail host. Personnel requirements for an NaPCP programme are considerably less than $CuSO_4$, which needs to be distributed by hand throughout the length of the canal. The chemical properties of NaPCP make it highly irritating to the skin, it has an unpleasant smell and is understandably unpopular with the field worker. Only improved packing, requiring a minimum of handling of the chemical before immersion, will remedy this. Quantitative chemical determination requires the development of permanent colour standards instead of the perishable types used at present. There is hope that these will be developed soon by Monsanto Chemicals in England.

(c) Snail control by mechanical means: Success has been claimed for comparatively wide wire mesh screens both in Egypt and the Sudan, using it at the entrance of major canals. The typical canal in Iraq is small, without branches and emanates directly from one of the rivers. It is difficult to devise a mechanical screen which will not let juvenile snails or eggs pass and whose mesh is still large enough to prevent frequent clogging by floating and suspended vegetation, and yet to provide for a cleaning crew which will operate 24 hours a day during the greater part of the year on all the innumerable small canals. A trial has been made in Iraq using a double layer of wire 8 and 16 mesh per square inch, the former on the current side. The trial was made in June in a single canal with the result that the water level of the canal rose very quickly and overflowed the embankment in about half an hour. The clogging material was a type of rootless grass and may only have been present during this particular season. On general grounds however this means of snail control in Iraq does not appear promising.

(d) Domestic water supply: Over most of Iraq where bilharziasis is endemic, groundwater is too salty to be used for drinking. Consequently surface water is the common source of domestic water supply, which means mostly canals. While drinking water is generally not a source of bilharziasis infection, washing in snail infested canals, and bathing, are frequent causes. The solution for small communities is not an easy one as filtration plants in general only become economically feasible and operative in larger communities. The WHO sanitary engineer of the bilharziasis project has developed a water filtration plant for small rural communities requiring a minimum of financial outlay and of maintenance. It is in principle a slow sand filter located in the centre of the canal bed, while the spaces between it and the embankment on either sides serving alternately as a sedimentation tank. Flow is by gravity to a tank on the side of the embankment from where it is withdrawn by handpump. It is hoped that pilot plants will soon be constructed and if successful an important step towards the solution of this problem will have been made.

(e) Planning of irrigation and flood control projects: This is mostly a problem of cooperation and of understanding between the health and the engineering planning authorities. While in general good engineering practices are good for bilharziasis control, engineers need to be made aware of the life cycle of the infection and of the specific control requirements. There is on the other hand a definite need for an engineer with intimate knowledge of irrigation within a bilharziasis control organization. A beginning in such fruitful cooperation has recently been made in Iraq.

(f) Possibility of alternate snail hosts for S.haematobium and infections in human beings with species other than S.haematobium: Although the answer will be obtained only by research, there is enough circumstantial evidence in Iraq to warrant examining the possibilities of snails other than Bulinus playing a part in transmission.

Little is known in Iraq regarding the non-human species of schistosomes. Cercarial dermatitis of unknown origin is known to exist in human beings. S.bovis and possibly other mammalian species are involved in it. In view of reports from Africa regarding human infections with other mammalian species, a complete understanding of bilharziasis in Iraq awaits a knowledge of species other than haematobium.

Needless to say a complete re-evaluation of all control concepts would have to take place, if positive evidence should result from such investigations.

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