

HARMONIZATION OF RESEARCH AND CONTROL IN SCHISTOSOMIASIS

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I have been employed by several different organizations during over 30 years working on schistosomiasis, the majority spent in endemic areas of the Caribbean, South America, Africa and the Western Pacific. Much of the work is best classified as applied research but sometimes it strayed to the extremes of either public health control programmes or pure research. Over this period, there have been several significant research developments that have altered our whole approach to control. Ideally, research and control should complement each other but, in reality, they sometimes have conflicting objectives. Public health workers understandably wish to provide immediate, short-term protection to the communities in their care, but research workers may, within ethical limits, reasonably want to observe untreated communities for extended periods in order to understand the underlying processes of transmission, disease pathogenesis and immunity to help develop more effective control measures.

*An example of this situation has occurred recently in Senegal where water development projects seem to have favoured the introduction and spread of *Schistosoma mansoni* in the Senegal River Basin. I have been asked to be the scientific consultant to the newly formed ESPOIR programme, linking European research organizations and the Senegal Ministry of Health, to reconcile the conflicting aims of public health workers, wishing to use whatever funds can be obtained for an immediate chemotherapy to try to eliminate the focus, at present confined to the vicinity of a relatively small, commercially run sugar irrigation scheme; and research workers who see a rare chance to study the development of immune mechanisms in adults in a community not previously exposed to the infection. This information could prove invaluable in understanding the development of immunity and the pathogenesis of disease, leading eventually to the development of vaccines to revolutionise the future approach to schistosomiasis control. Some of our proposed solutions will be described in which, without denying such treatment as infected people may ethically require and politically demand, we will attempt to allow the research workers to gather the data they need.*

Key words: schistosomiasis – control

When I was invited to talk at this conference, I chose my title because I had just become involved in a programme on *Schistosoma mansoni* in Senegal, where there appeared to be an almost irreconcilable conflict between the objectives of the public health authorities and a number of interested research groups. I was asked to help formulate a programme that would satisfy both - a thankless and, perhaps, impossible task! Why, though, was I qualified for this role? To answer this question I would like to set the scene by reminiscing briefly on my work on schistosomiasis over the last 30 years or so, and then summarise some of the changes that have taken place. After that, I will explain the situation in Senegal and how

we are trying to resolve the differences between the various parties.

REMINISCENCES

My first experience with schistosomiasis was on a student expedition to Ghana in 1958 where I was singularly unsuccessful in finding any *Bulinus truncatus rohlfsii*, a snail with a curiously discontinuous distribution, but which later became the main intermediate host transmitting *S. haematobium* in the man-made Volta Lake. I mention this to illustrate how what seems to be merely an matter of academic interest may, ultimately, have practical implications.

Next, I worked for 6 years in East Africa, mainly in Tanzania, assessing the risk of schistosomiasis associated with irrigation developments. Again, this was research, but with more obvious practical applications. *Bulinus* spp., the intermediate hosts of *S. haematobium*, despite their widespread distribution throughout East Africa, did not normally thrive in irrigation canals. Thus, urinary schistosomiasis appeared to pose no significant threat. In contrast, *Biomphalaria* spp., the intermediate hosts of *S. mansoni*, were confined to the inland plateau, but thrived in irrigation canals, so that intestinal schistosomiasis was a significant threat. We actually watched the prevalence climb in one newly created scheme from < 5% to over 70% within three years. However, unless the man-made schemes permitted their invasion by *Biomphalaria* spp. (by no means impossible), the risk of *S. mansoni* spreading to the coast seemed minimal. These predictions have proved accurate, even to the appearance *Biomphalaria* spp. on the coast.

In 1966, I moved from East Africa to St Lucia in the Caribbean to join an experimental project testing the predictions of the late Professor George Macdonald's theoretical model on the relative efficacy of different control measures (molluscicides, chemotherapy, sanitation or water supplies) applied alone or in combination against *S. mansoni*. Thus, it was a research programme incorporating control. We had a large, if not unlimited, budget and specialist staff not normally available to public health authorities. We hoped, of course, that our findings would be of value world wide, not only in St Lucia. I had to develop a mollusciciding programme to control the local snail, *B. glabrata* in the difficult rural conditions of Cul de Sac valley. These conditions required handspraying of still waters as well as the technically easier treatment of flowing waters. An experimental, labour intensive mollusciciding programme, based on extensive field studies on the snails, suppressed transmission over three years with parallel declines in human prevalence and intensity - as predicted by Macdonald's model. It was never intended to be a cost-effective, public-health control measure. Subsequently, though, combining simplified mollusciciding with chemotherapy reduced and held *S. mansoni* incidence, prevalence and intensity to negligible levels.

In 1974, I became the parasitologist to a group of immunologists in Nairobi, Kenya,

looking for evidence of immunological mechanisms in schistosomiasis, and I still visit Kenya regularly since my return to England in 1981. This, surely, was "pure" research, although we hoped that it might open the road to an effective vaccine. Initially we studied *S. mansoni* in mice and baboons, looking where possible for correlates of our findings in infected hospital patients. We showed that peripheral white blood cells (probably neutrophils) from baboons could kill antibody-coated schistosomula *in vitro*, and that human eosinophils had the same capability. Baboons developed a partially predictable resistance after a primary infection. Alas, neither specific nor non-specific vaccines induced predictable immunity to *S. mansoni*; although an irradiation-attenuated, live, vaccine proved highly effective against *S. haematobium*.

Hospital patients are of limited value unless one knows when, where and how they have acquired their infections. It was essential to work on communities in endemic areas. A pilot study showed that this was possible, using very basic field laboratories and taking various samples back to better equipped laboratories for more complicated studies. Of course, community studies also need extensive field work to characterise the pattern of infection within the community (age-specific prevalence, intensity, incidence, and morbidity), combined with behavioural, snail and cercario-metry studies to detect active transmission sites. We were looking primarily for evidence of the development of immunity in man. To avoid ethical problems, we incorporated chemotherapy into our experimental design, treating a study population and then monitoring reinfection for a limited follow-up period before offering appropriate retreatment. We found differential reinfection rates, that may have an immunological basis, among children and adults with similar exposure after treatment to active transmission sites. As these studies developed, we compared different chemotherapy strategies against schistosomiasis and obtained useful information for the development of operational control programmes. Thus control and research developed hand in hand.

As the study progressed, it was necessary to foster an interchange of ideas, staff and materials between Kenya and laboratories in the developed countries. Progressively more complicated immunological studies suggested that protective immune mechanisms, developed

soon after initial infection, are unable to function adequately until other, non-protective immune responses die down, especially those mounted early in the infection against tissue eggs. Unravelling the complicated interactions of the various immunological processes involved required advanced laboratory facilities within easy reach of the field study areas, and, more recently, clinical beds, which also allowed parallel studies on the immunological bases of schistosomal pathology.

So, to summarise, I have participated in projects involving both pure and applied research, moving in some instances into small scale public health control programmes. The first 20 years were spent working full time in the tropics, where I became more and more involved in the organization and administration of these programmes. I also acted as a consultant or advisor for similar projects in Africa, the Caribbean and the Philippines.

I remember on one trip being shown a report from a previous, eminent advisor saying firmly that the time had come to stop research and start control. I know what he meant, even though I do not entirely agree with him. However, this does illustrate the distinction many people make between the two. I personally feel that they cannot be separated, even though clinicians, research workers and public health workers often see things in different lights. With my background, though, I feel I can speak sympathetically to all these groups (Fig. 1).

THE CHANGING PATTERN OF SCHISTOSOMIASIS RESEARCH AND CONTROL SINCE 1950

There have been considerable shifts in emphasis and goals in schistosomiasis research

and control in the last 40 years, due to the development of new diagnostic and control methods; to advances in existing (and the emergence of new) branches of the biomedical sciences; and to experience gained when applying findings to the field. These changes may be summarized in Table I.

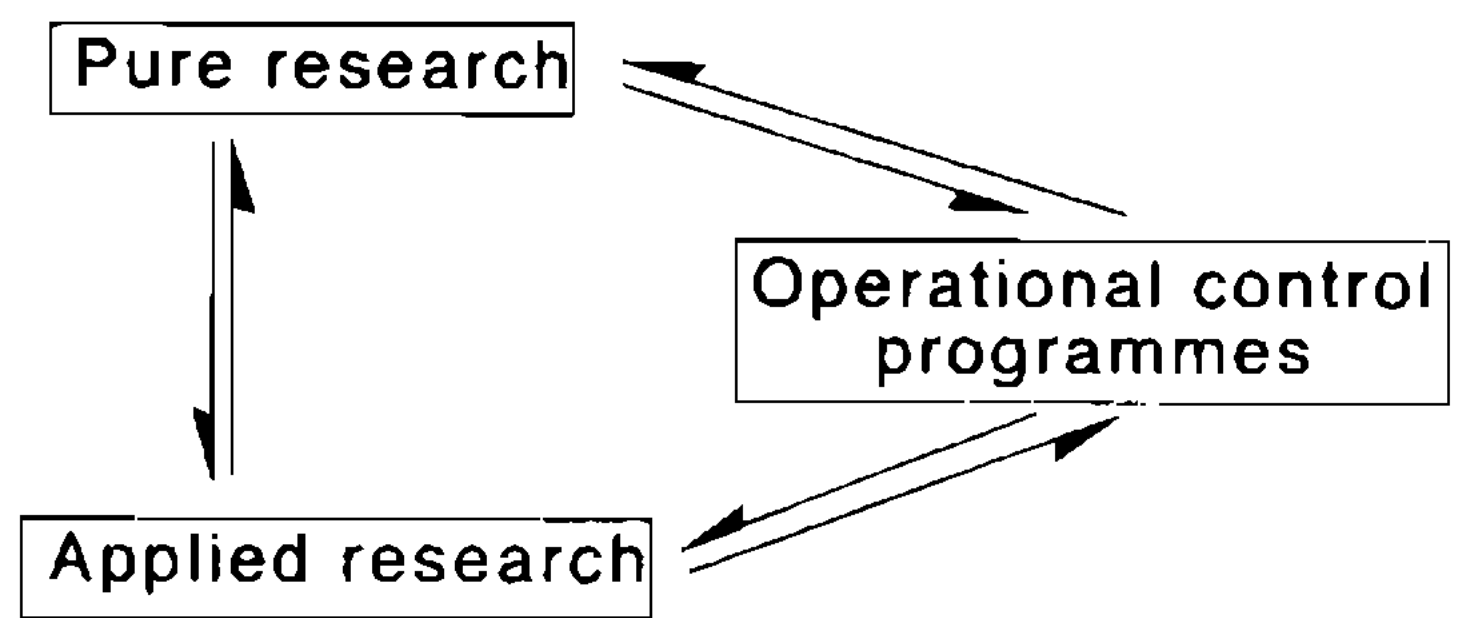


Fig. 1: the research and control trinity.

In the 1950s, the antimonial drugs available were too dangerous for community use, and, even then, engineering methods were considered too expensive for general use solely to break the schistosomiasis transmission cycle. Public health education without the necessary engineering back up had little hope of success. By analogy with malaria control at the time, the main hope of protecting communities was with chemical (molluscicidal) snail eradication, especially in man-made environments such as irrigation schemes. There were high hopes when Bayluscide and Frescon were released in the 1960s but their initial promise in Egypt did not live up to expectations; and they proved equally unsatisfactory in the Sudan. Nevertheless, molluscicides still had a place in the management of snail populations to minimise transmission. Their use dwindled, though, with a massive price rise after the oil crisis early in

TABLE I

Activity in schistosomiasis research and control in the last five decades

Decade	Activity				
	Snails	Chemotherapy	Research	Immunology Diagnosis	Vaccines
1950s	++	+	+/-	+/-	-
1960s	++++	++	+	+	-
1970s	+++	+++	++	++	+/-
1980s	+	++++	+++	++	-
1990s	/+	/+++	++++	?+++	?++

the 1970s, plus increasing environmental concern.

The 1970s saw the arrival of a new generation of safe drugs, effective for community use. However, even these (expensive) drugs failed to eradicate the parasites and emphasis switched to human morbidity control in the 1980s, where possible in Primary Health Care programmes to minimise delivery costs and increase community participation. Morbidity control owed much to our increased understanding of schistosomiasis epidemiology after the introduction of quantitative faecal diagnostic techniques in the 1960s and 1970s. This revealed the correlation between the intensity of infection and the risk of developing pathology and disease.

Forty years ago, schistosomiasis immunology, like that of most other helminthic infections, had little to offer except the possibility of diagnostic tests (to replace the slow, unpleasant and cumbersome parasitological methods) and the dream of a vaccine. Parasite immunology took off in the 1960s, and interest in schistosomiasis accelerated during the 1970s and 1980s so that, today, the majority of schistosomiasis papers published are immunological. It is now generally accepted that man develops some form of natural, protective immunity, and that immunological processes underlie the pathogenesis of schistosomal disease. The unravelling of the processes is in progress, but we are still without either a protective vaccine or a standardised immunodiagnostic test. However, before dismissing 25 years of immunological research as an expensive failure, remember that it took 50 years from the discovery of the original, crude, antimonial drugs to develop effective, safe drugs suitable for community use; drugs which are still not really in widespread use, partly due to cost but partly because we are unsure how best to use them.

SENEGAL

Last year I visited Senegal to see an epidemic of *S. mansoni*. In early 1988, doctors studying diarrhoea in the town of Richard Toll, about 100 km inland from the mouth of the Senegal River, diagnosed the first case of *S. mansoni* ever to be found in this area. Over the next 18 months, their clinic detected another 3,000 or so cases. The local medical authorities wanted immediate preventative ac-

tion to curb this "epidemic". However, this unusual, if not unique, situation offered a considerable research opportunity to investigate the immunological response of a naive adult population soon after its first exposure to *S. mansoni*, specifically to dissociate duration of previous exposure from age (in particular hormonal changes at puberty) in the development of resistance to reinfection. Research workers wanted time to characterise the current immune status of the community before the picture was obscured by indiscriminate treatment programmes. First, though, was this really a recent epidemic, not merely an "epidemic of diagnosis", and was it sufficiently serious to justify immediate control activity?

The Senegal River rises in the mountains of Mali, where it is fed by seasonal rains falling between April and July, and runs generally westwards across the hot, arid coastal plain, forming the boundary between Senegal and Mauritania. Apart from the obvious potential for hydroelectric power, the deep, fertile, alluvial silts accumulated on the coastal plain have tremendous agricultural potential using irrigation. Perennial irrigation had been prevented in the past by seasonal flow variations and intrusion of sea water some 200 km upstream during periods of low flow, making both the water and soils unsuitable for many crops. Construction of two dams, one near the river mouth and the other inland near the base of the hills, would eliminate both problems so that the full agricultural potential of the area could be realised.

In the 1970s, development plans were prepared and, in fairness to the authorities, extensive studies were carried out to determine the environmental impact and health risks, as well as the socioeconomic and political consequences, of the proposed dams. Surveys in the late 1970s revealed a patchy distribution of *S. haematobium* in the Region Fleuve associated with several Bulinid snails; but no *S. mansoni*, even though a few *Biomphalaria* colonies were reported from habitats protected from the seasonal salinity. *S. mansoni* was present in southern Senegal, but *S. haematobium* then seemed to be the principal schistosomiasis threat in the Region Fleuve.

The lower dam was completed in 1987, scarcely a year before the first case of *S. mansoni* was reported at Richard Toll. However, commercial production of irrigated sugar

by the Compagnie Sucriere Senegalese (CSS) began at Richard Toll in the late 1960s. Sugar is especially sensitive to salinity and, before large scale cultivation was possible, the CSS had to desalinate the soils. They evolved an ingenious method for storing fresh water in the natural Lac de Guiers for use when sea water flowed up the river. This regimen was introduced during the preconstruction impact surveys, which found no *Biomphalaria* spp. in the expanding CSS irrigation scheme, but reported a small colony in the marshy margins of the Lac de Guiers. As sugar production expanded, seasonal labour for cane cutting was recruited elsewhere in Senegal. Undoubtedly, infected immigrants from the south introduced *S. mansoni* to Richard Toll just as snails from the Lac de Guiers were colonising the CSS irrigation system as salinity decreased. Thus, *S. mansoni* transmission at Richard Toll probably predated the completion of the downstream dam by several years.

All this may seem irrelevant to public health workers, but could be critical for research projects trying to study patients only recently exposed to schistosomiasis. A further complication was the recent arrival of thousands of refugees expelled from Mauritania. Consequently, accurate demographic surveys will be necessary to separate immunologically naive adults from those who have had previous exposure to schistosomiasis.

THE ESPOIR PROGRAMME

Senegal is a former French colony which has retained close links with France where, recently, control of some overseas aid programmes has been devolved from central to local government. The Region-Nord, Pas de Calais (RNPdC) had historic links with the Region Fleuve, Senegal and set up a bilateral aid programme. Not surprisingly, the Institut Pasteur in Lille, the capital the RNPdC, became involved when the schistosomiasis epidemic was reported. Professor Capron recommended several people, including myself, for a mission to review the situation at Richard Toll to: (a) suggest suitable control methods for use against the "epidemic", and (b) identify opportunities for relevant research.

Such a programme would have greater credibility if it involved other European countries, and it was an ideal candidate for an initiative provisionally named "the European Special

Programme for Operational and Integrated Research". Its initials form the acronym "ESPOIR" – literally "HOPE" in French. ESPOIR aims to help developing countries to use existing techniques to control their endemic health problems and, also, to promote new solutions by research employing modern technologies. ESPOIR has now adopted the Senegalese schistosomiasis programme, which has also been recognised by the World Health Organisation. Agreements have been signed between ESPOIR and the Senegalese Government. The European Community has provided a financial contribution to supplement the seed money provided by RNPdC, and agreed to consider substantial future funding for strengthening and training. Funds for training have been promised by a private charitable Foundation, and the French Government has created two technical cooperation posts in Senegal.

THE REALITY

The above plans sound all very grand, but what is the reality of the situation at Richard Toll? The population is estimated as at 50,000 to 75,000 people of several ethnic groups, mainly Peuhl and Wolof. Some are agriculturalists but others were originally pastoralists, used to a nomadic existence following their herds of domestic animals. Islam is the predominant religion but there are substantial Christian and pagan minorities. The town is divided into 7 or more "Quartiers" (neighbourhoods), of 5000 to 7000 or more inhabitants, each with its own local administration. The main employer is the CSS, which both grows and refines sugar, but there is an increasing number of peripheral supply and service businesses.

Each family group traditionally lives in several separate houses situated within a single, walled compound. In the oldest Quartiers, wealthy compounds are connected to unreliable and intermittent electricity and piped water systems. However, most households have to rely on communal taps (4 to 10 per Quartier) or borehole wells. When these become too overcrowded or fail, the people not surprisingly turn to the nearest surface water supply, either the Senegal River or the irrigation canals that flow through some Quartiers. The people have even adopted the CSS irrigation technique: semi-permanent siphons made of plastic hosepipes take untreated canal water several hundred metres directly into their compounds. However, for bathing in the morning

and evening many people seem to prefer the river or the canals. Sanitation, if it exists, is invariably a pit latrine, but, again, it is obvious that many people defaecate in secluded areas close to the bathing sites. In short, conditions are ideal for *S. mansoni* transmission: a dense population with inadequate sanitation and dependent on unprotected water supplies.

Government medical facilities are limited to a single Government doctor, responsible for the entire district (not just the town of Richard Toll) with a midwife, several nurses and a laboratory technician trained locally. Additional help is given by two visiting Belgian clinicians. All are based at a Health Centre which has a dispensary, a simple operating theatre, 24 beds, and an elementary diagnostic laboratory. The CSS provides its staff and their families with medical facilities, and employs four doctors and several nurses at a newly constructed clinic which has still to be fully equipped and staffed. The CSS clinic will also see other people who can afford their services. Serious cases from Richard Toll can, if necessary, be sent to the Regional Hospital in St Louis, about an hour away by tarmac road.

Regarding the schistosomiasis "epidemic", the existing Health Authorities are inadequate for anything much more than symptomatic treatment of cases presenting at their clinics. There is no shortage of interest in the problem, though. The Senegal River Basin Authority is concerned with all aspects of the impact of the new dams, but has no expertise in schistosomiasis. ORSTOM, a French Government Overseas Research Organisation, in collaboration with a Senegalese Organisation, ISRA, has performed some preliminary snail studies. It is currently carrying out demographic and geographic studies as part of its own "Water and Health" programme to design improved sanitation and water supplies for the town, the construction of which will require substantial external investment. Belgium has already provided the two doctors who helped discover the "epidemic" and monitored its progress. Their control efforts were initially restricted by limited funds to purchase drugs directly or through the Senegal Government. Supplies of Praziquantel have now been donated by the RNPdC and the Swiss Government, in addition to those imported by the CSS which now gives mass treatment to all migrant workers and their families before they

return home. Probably over 10,000 people at Richard Toll have now been treated with one or more doses of Praziquantel. However, should the problem be tackled in this piecemeal way?

THE ETHICAL DILEMMA

We were acutely aware last year of pressure at local and Government level to take immediate action against schistosomiasis; to treat sick people and to protect the rest of the community. With an estimated prevalence of over 50%, the most obvious emergency solution, based on the Brazilian SUCAM programme, would be a mass chemotherapy campaign. The problem would then be merely a logistical one of delivering the drug. Alas, results from Brazil, Egypt and several other countries show that neither single nor even repeated mass treatment campaigns alone will eradicate schistosomiasis: reinfection inevitably occurs. Regular mollusciciding of the irrigation canals and certain other water bodies could reinforce chemotherapy by minimising transmission, but, in the absence of adequate precontrol studies on the snail populations to define transmission seasons, if they exist, would require expensive blanket mollusciciding every 4-6 weeks. Improved water supplies and sanitation, coupled with health education, may help but they are expensive and will take years to construct.

In the past, not defining the schistosomiasis problem properly has resulted in some expensive failures of control programmes. Those that have achieved some measure of success have been based on careful precontrol studies (this applies to chemotherapy as much as to any other control measure). Does this mean, though, that people must be deprived of effective treatment in the precontrol period? This problem is, perhaps, the main source of friction between clinicians, public health workers and research workers, especially since the arrival of safer drugs such as Oxamniquine and Praziquantel. Clinicians feel an immediate responsibility to "cure" their patients. Public health workers also want immediate action to protect an infected community unless a limited delay will ultimately produce a more effective community care programme. In contrast, research workers may want to monitor people for prolonged periods, without the complication of chemotherapy; or to include untreated, control groups in comparative studies to measure the beneficial effects of any intervention (Table II).

TABLE II

The objectives of different health workers

Group	Objective(s)
Clinicians	a) Cure patients (Cases alone)
Public health workers	a) Protect whole community (Cases and normals)
Research workers	a) Study "undisturbed" systems (Cases alone or with normals) b) Measure effects of interventions (Cases alone or with normals)

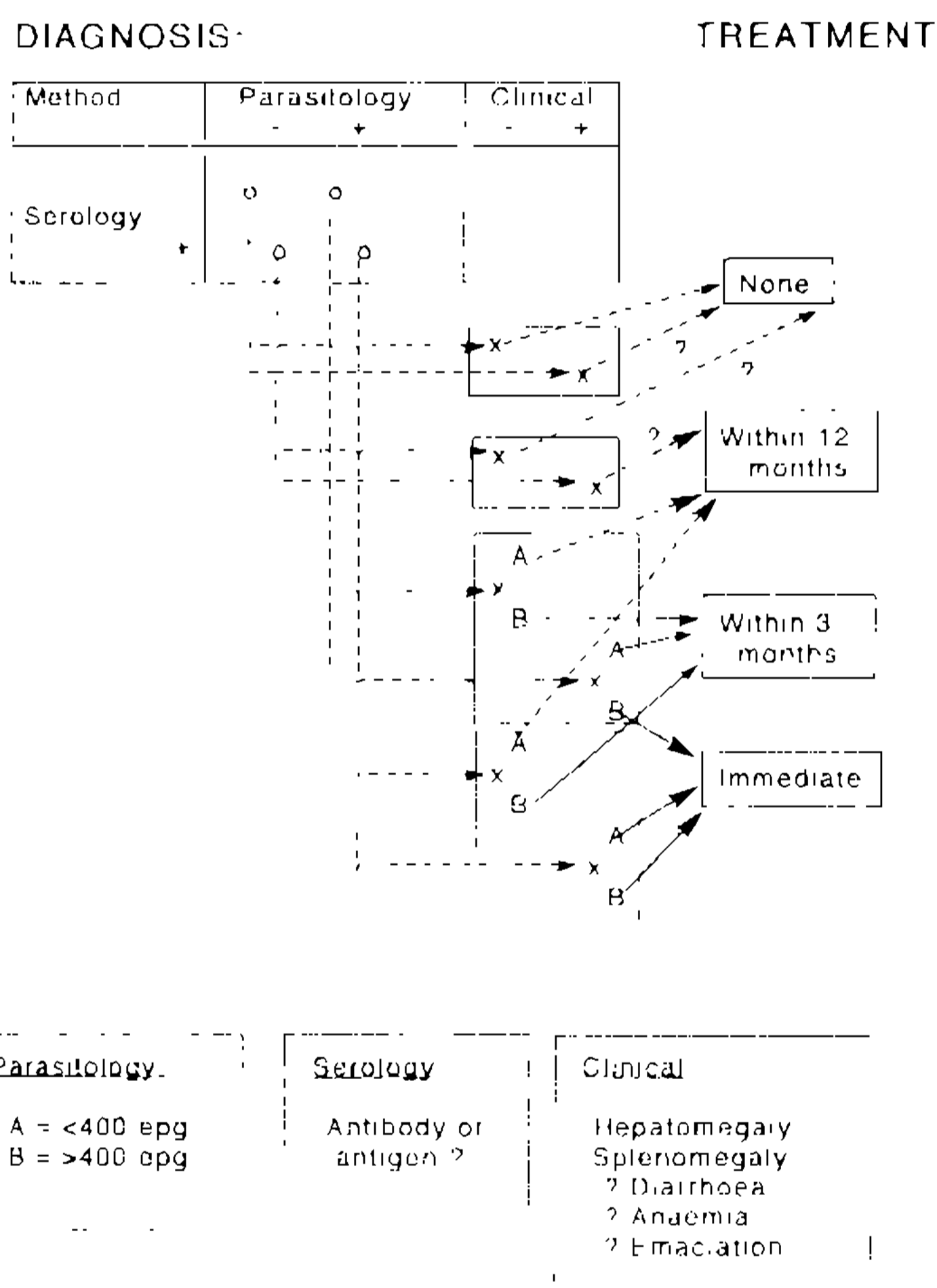


Fig. 2: possible algorithm for deciding on need and rapidity of treatment.

Obviously, nobody would deprive seriously ill patients of treatment, but how can we define seriously ill? At one extreme, public health and research workers are usually content with some predetermined criteria, such as a minimum intensity level (e.g. 400 eggs/g of faeces), possibly with evidence of hepatomegaly or hepatosplenomegaly. At the other extreme, though, clinicians argue that the very fact a person goes to a doctor is proof enough of their need for treatment. Any operational or integrated research at Richard Toll will need to agree some clearly defined, objective crite-

ria of severe schistosomiasis requiring immediate treatment; and also ethical guidelines to define those infected subjects from whom treatment may legitimately be withheld and for how long - weeks, months or years? This raises the question of diagnosis (Fig. 2).

DIAGNOSTIC PROBLEMS

Can *S. mansoni* be diagnosed solely on clinical signs and symptoms? Clinicians at Richard Toll are convinced that diarrhoea is pathognomic for schistosomiasis. I am not properly qualified to speak on differential diagnosis, but is diarrhoea, with or without frank blood, any more indicative of *S. mansoni* infection than a headache that fails to respond immediately to treatment with aspirin is diagnostic of cerebral *S. japonicum*? Even detecting an egg in the diarrhoea does not prove that *S. mansoni* is the causal agent: conditions at Richard Toll lend themselves to many other viral, bacterial and protozoal infections known to cause diarrhoea.

The classical method of diagnosing *S. mansoni* is by identifying eggs in faecal samples. Simple, direct faecal smears, upon which the initial reports from Richard Toll were based, are perfectly acceptable for qualitative diagnosis, but are notoriously insensitive for detecting light infections. The Kato-Katz "quantitative" faecal smear is a simple, specific field technique of reasonable sensitivity that allows sufficiently accurate estimates to derive community age- and sex-specific intensity curves; and, within certain limits, for monitoring the efficacy of chemotherapy. However, two problems have been encountered in its use at Richard Toll. First, in the hot (35 °C+) and dry conditions that prevail for much of the year, the preparations dry out rapidly before they can be counted, sometimes even during the count. Careful storage of the slides after preparation and an air-conditioned laboratory should overcome this problem. The second problem is the allegedly high proportion of diarrhoeic stools (reported as 50% or more) that renders the conventional template useless. However, a recent community survey suggested that this problem had been over-estimated and we hope that we will not be forced to resort to more complicated volumetric measurements.

Nevertheless, simple parasitological diagnosis is not entirely straight forward. Unfortunately no reliable quantitative, specific and

sensitive immunodiagnostic test is commercially available, but, as we have heard, work is progressing on a number of experimental methods for detecting both antibodies and antigens. The programme at Richard Toll will provide an ideal opportunity to test them under field conditions.

CONTROL OBJECTIVES

Control of schistosomiasis at Richard Toll must be looked at in two time-scales.

I – Short-term emergency measures, including: (a) immediate treatment of anyone who is seriously ill; (b) preventing the rest of the population acquiring heavy infections, and (c) preventing the spread of the infection within the Region or elsewhere in Senegal.

II – Long-term measures, including: (a) development of cost effective chemotherapy and, possibly, snail control; (b) testing candidate vaccines for use alone or in conjunction with chemotherapy, and (c) general improvements in living standards, especially the provision of safe water and proper sewerage systems.

Of these objectives, Ia is probably within the competence of the existing health authorities if they can be provided with the drugs and suitably trained clinicians. Ib, in which ESPOIR should participate, requires some preliminary, longitudinal studies to define the patterns of infection and transmission (which will be an integral part of IIa) before any sensible short term suggestions can be made. Ic is probably not the immediate responsibility of the ESPOIR programme. It is partly covered by the CSS treatment programme for its migrant, seasonal workers, but malacological surveillance is needed elsewhere in the Region to monitor any further spread of *Biomphalaria* spp.

Item IIa should be covered by the ESPOIR programme operational arm. IIb is clearly suitable for the the ESPOIR programme research arm, and would entail substantial preliminary studies to define the immune status of the population before any attempt could be made to test vaccines. IIc is beyond the direct capability of the ESPOIR programme, and should be the responsibility of the Senegal River Basin Development Authority, working in conjunction with the Senegal Government and ORSTOM's "Water and Health" programme. However, there is a danger that the activities of these different

groups will interfere with each other if they work independently. Even within the ESPOIR programme, there could be friction between the operational and research arms.

IMPLEMENTATION

A joint committee representing these different groups and agencies has already been formally established, and, although reliable funding is needed for regular meetings, the RNPdC financed an initial meeting that has already allowed some degree of collaboration. The CSS can provide some logistic support and has made available records of people they treat. ORSTOM's demographic information is available to the ESPOIR programme, and they will undertake additional demographic studies as required, as well as collaborating with ISRA and ESPOIR to expand the malacological studies. They will also run a parallel study on wild rodents which could, potentially, act as reservoir hosts.

My prime concern, though, is to get the ESPOIR programme under way. A French medical epidemiologist started work last December at St Louis in the Ministry of Health. His responsibilities include the supervision of the project at Richard Toll when funds are released to recruit and train staff, and he is liaising with those people who are currently active at Richard Toll. In addition, a small study funded by separate EEC funds was started in July by the University of Leiden to compare quantitative parasitological diagnosis with antigen detection before and after treatment with Praziquantel.

The first priority is to establish a temporary laboratory at Richard Toll, probably in an ORSTOM building, until our own small laboratory can be built at the Government Health Centre. Local staff will have to be recruited and trained, and a senior French Laboratory technician has still to be found to live at Richard Toll to oversee the day to day running of the project.

Our immediate plans are for a small survey of representative subsamples of 100 to 150 people from each Quartier to obtain a general picture of the prevalence and intensity of infection by age and sex. Any infected subjects will be offered treatment although the numbers will be too small to affect the overall transmission picture. Then, one Quartier (prob-

ably the most seriously affected) will be selected for a full epidemiological survey to precede some form of mass chemotherapy, the effects of which will be monitored over the following year, paying particular attention to reinfection patterns. Once this study is under way, similar or modified treatment programmes, possibly incorporating snail control, will be phased in one at a time for the remaining Quartiers over a 2 or 3 year period.

Meanwhile, regular snail sampling is starting at about 20 sites representing different snail habitats and all the Quartiers to provide an overall picture of transmission. Additional sites will be selected in the first Quartier chosen for mass chemotherapy.

This 'operational control' programme will then form the stem on which to graft the various "research" programmes. By staggering the treatment programme, it is hoped to provide sufficient time for the research groups to complete their pretreatment studies, simultaneously building up information to improve each successive treatment campaign, and satisfying the legitimate concerns of the public health authorities. A cohort of up to 400 people will be selected in each Quartier, after the initial survey and before control starts, for special research studies involving a more detailed schedule of stool, blood and urine sampling, and clinical evaluation, especially ultrasonography to investigate changes in pathology. Obviously, we will have to maintain the highest possible level of community participation, especially from the members of the cohorts.

Most of the European groups likely to have an input into the ESPOIR programme may need time to obtain funding and staff. In addition, many already have their own research programmes involving other countries and their grant applications may not be specifically for Senegal. We are trying to set up a central coordinating system through the overall Director of the ESPOIR programme, Professor Capron, to reassure grant-giving agencies that they will not be funding identical Senegal projects, and, at the same time, ensure that the European collaborators have the necessary degree of autonomy while maintaining full liaison with and participation of appropriate Senegalese workers and organisations.

Inevitably there will be an overlap of interests between some research groups. Some element of competition is healthy, but we will try, if possible, to encourage it to be open. In a climate of trust, people should share ideas and reveal preliminary findings in the knowledge that other groups will not try to preempt their work. Joint publications of completed work will be encouraged but not imposed. It will be a pity if such people divert their energies into discordant, cut-throat competition, rather than channelling them harmoniously towards the primary objective: to improve the lot of people exposed to *S. mansoni*. If the name ESPOIR is really to mean HOPE for these people, then our motto must surely be COOPERATION. Can anyone suggest a suitable phrase or sentence for which COOPERATION could be the acronym?