THE LEISHMANIASES AND DEVELOPMENT: RESEARCH ISSUES

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INTRODUCTION TO THE LEISHMANIASES

The leishmaniases constitute a group of diseases that have been relatively neglected in terms of research in the past; although they are of worldwide distribution. As such, the socio-cultural and economic relationships of the disease remain virtually undocumented, and perhaps also little appreciated. This paper for discussion is attempted with that underlying thought in mind; it is aimed at generating key issues that need to be investigated, and to examine some approaches towards achieving them. This disease is also thought of as an example where research would also have ramifications in the control of other tropical diseases existing in the same area.

The International Development Research Centre has, and continues to, support various research projects on the leishmaniases in different parts of the world and it is considered one of its priority areas of support.

Forms of leishmaniases affecting man and their transmission

The leishmaniases are caused by the protozoan parasites of the genus Leishmania and known to occur in man in at least three major clinical forms; visceral leishmaniases (VL), cutaneous leishmaniases (CL) and mucocutaneous leishmaniases (MCL). These three entities were based on clinical distinctions and thought to be due to different parasitic species, respectively, Leishmania donovani, L. tropica and L. braziliensis which are now each known to have several closely related subspecies. The diseases are transmitted by the bite of sandflies, mainly Phlebotomus (in the Old World) and Lutzomyia (in the New World). The sandflies become infected either from domestic or sylvatic rodents, dogs and other mammals, or less frequently, from man. Human to human transmission (or anthroponosis) of these infections has only been shown to occur in a few areas, such as India and Bangladesh, while transmission from animal reservoirs (or zoonosis) appears to be the widespread mechanism in endemic regions.

Geographic distribution

The geographic distribution of the leishmaniases is quite wide, but scattered. Asia, the Middle East, Africa and Latin America are all affected by one or more of the forms. For instance, VL is endemic in several parts of Africa, the Indian subcontinent and Latin America, and occurs sporadically in China, the Mediterranean Basin, southwest Asia and southern parts of the Soviet Union.[1] CL also has a very similar distribution in the world. MCL, on the other hand, is found in Latin America, although cases of clinically similar oro-nasal disease have also been reported in Ethiopia and the Sudan.

Diagnosis and clinical manifestations

Reliable laboratory diagnosis of the leishmaniases is still dependent on costly and time consuming methods. The techniques generally available in PHC facilities are often deficient in terms of sensitivity and specificity. Intradermal (Montenegro) skin tests, parasite visualization in biopsy material from lesions, bone marrow and liver, and serological tests, are all being used with varying degrees of success.

The clinical manifestations of the leishmaniases show a great variety in the different forms and in different areas. However, in general CL may manifest as simple self-healing lesions of the skin or as widespread diffuse lesions of a painful and chronic nature leading to disfiguring scars.[2] It is known that the time elapsing between infective sandfly bites and the appearance of signs may vary from three weeks to as much as three years.

MCL usually is first manifested as a papular skin lesion which transforms into a crateriform ulcer that could later spontaneously disappear. Commonly, however, parasite invasion of the mucous membrane of the upper respiratory tract occurs, causing extensive destruction of surrounding tissue. Naso-pharyngeal cartilages, including the palate, become eroded, with frequent involvement of the trachea and larynx, resulting in gross mutilation, disfiguration and, commonly, to death due to secondary lung infection due to mouth breathing.[3] Both CL and MCL forms are handled by the affected people in various ways. Traditional treatment methods for cutaneous lesions use drastic local preparations of various types, including battery acid, tar, and toxic herbal concoctions, none of which cure the disease, and often cause severe injury.

The currently available drugs are toxic and may require the patients to be hospitalized for treatment, often for prolonged periods.

VL (or kala azar), involves leishmanial parasites infecting the reticulo-endothelial cells of various organ systems of the body, mainly the spleen, bone marrow, liver, lymph nodes and skin. Anaemia, recurrent fever, loss of weight and increasing enlargement of the liver and spleen are characteristic of VL, and progressive wasting is common. Treatment is often very difficult. Recovery is rare in non-treated cases, which have a high morality rate. After recovery from the acute phase, VL patients may develop cutaneous lesions that persist (post-kala azar dermal leishmaniasis - PKDL). These lesions contain abundant parasites which could constitute a reservoir of infection with relevance to transmission.

Control measures

In principle, the leishmaniases can be controlled by intervention focused on vulnerable pathways in the cycles of transmission, whether it be an anthroponosis or zoonosis. The following are some examples of control measures.

a) Parasite control by treating infected individuals. These measures have been largely unsuccessful due to the lack of effective and feasible

drugs of choice, and due to the presence of animal reservoirs maintaining the natural cycle.

b) Vector sandfly control measures, either by larvicidal or adulticidal approaches. In the past, some measure of success was accidentally achieved during malaria vector control programs using residual insecticides. However, the highly varied breeding ecology of sandfly larvae, as well as the complex and mostly unknown biting habits of adult sandflies, does not make this approach feasible in most situations.

c) Preventive measures aimed at protecting the groups at risk in the community. These approaches have rarely been attempted due to:

i) the risk factors of acquiring the infections not being identified;

ii) the non-feasibility of using chemicals such as repellents to impede man-vector contact;

iii) the lack of antileishmanial prophylactic drugs for community-wide use; and

iv) unpopularity of bed nets to prevent sandfly attack because they decrease ventilation and make conditions hotter.

d) Animal reservoir control. Although such measures have been attempted on a very limited scale, impediments to their success in controlling the disease have been:

i) the lack of complete knowledge of all the reservoir hosts involved;

ii) some reservoirs are domestic animals and hence the reluctance for their destruction; and

iii) the lack of economically feasible methods of their control.

It is becoming increasingly apparent that significant cultural aspects and lack of community education on the disease need to be addressed, if the above listed control measures are to be practiced as viable approaches.

Factors associated with development

a) The affected populations

The Leishmaniases predominantly affect poor rural communities.

Most sufferers belong to the economically viable age groups of populations.

Often males are more affected and a strong association with occupational exposure is evident. For instance, in Ethiopia, children

(4-14 years) herding livestock show the highest prevalence of CL, acquiring the infection from sandflies infected mainly from the hyrax. In the Ethiopian southwest, the same animal reservoir is associated as the source of infection of VL for coffee-growing adult men.[4]

In Kenya, livestock herding nomadic populations are mainly affected with VL where sandflies breeding in termite hills and gerbil reservoirs are involved in the transmission of infection.[5]

In Belize and in the Yucatan peninsula of Mexico, a form of CL, Chiclero ulcer, is acquired mostly from the forest by chicle gatherers, other agricultural workers and children.

In the Andean and Amazonian regions of South America where CL and MCL are common, colonization schemes and resettlement, deforestation and cultivation of new land are known to be associated with widespread human infection, which is acquired from various animal reservoirs. People involved in hunting, fishing and gathering activities are the most affected.

In Bihar and the Bengal regions of India where serious and large outbreaks of VL have occurred, farming populations were predominantly affected in apparently man-vector-man transmission occurring mainly in human habitations.

In Tunisia, as well as in the Middle East, it appears that large scale construction programs for water resources have increased the prevalence of CL and dogs and rodents are incriminated as reservoirs.

b) Overview of leishmaniasis infection and disease pathways.

See Figure 1.

c) Socio-cultural aspects

The following factors need to be considered in examining socio-cultural aspects relevant to the leishmaniases:

i) General demography and educational status in the community, including occupational surveys.

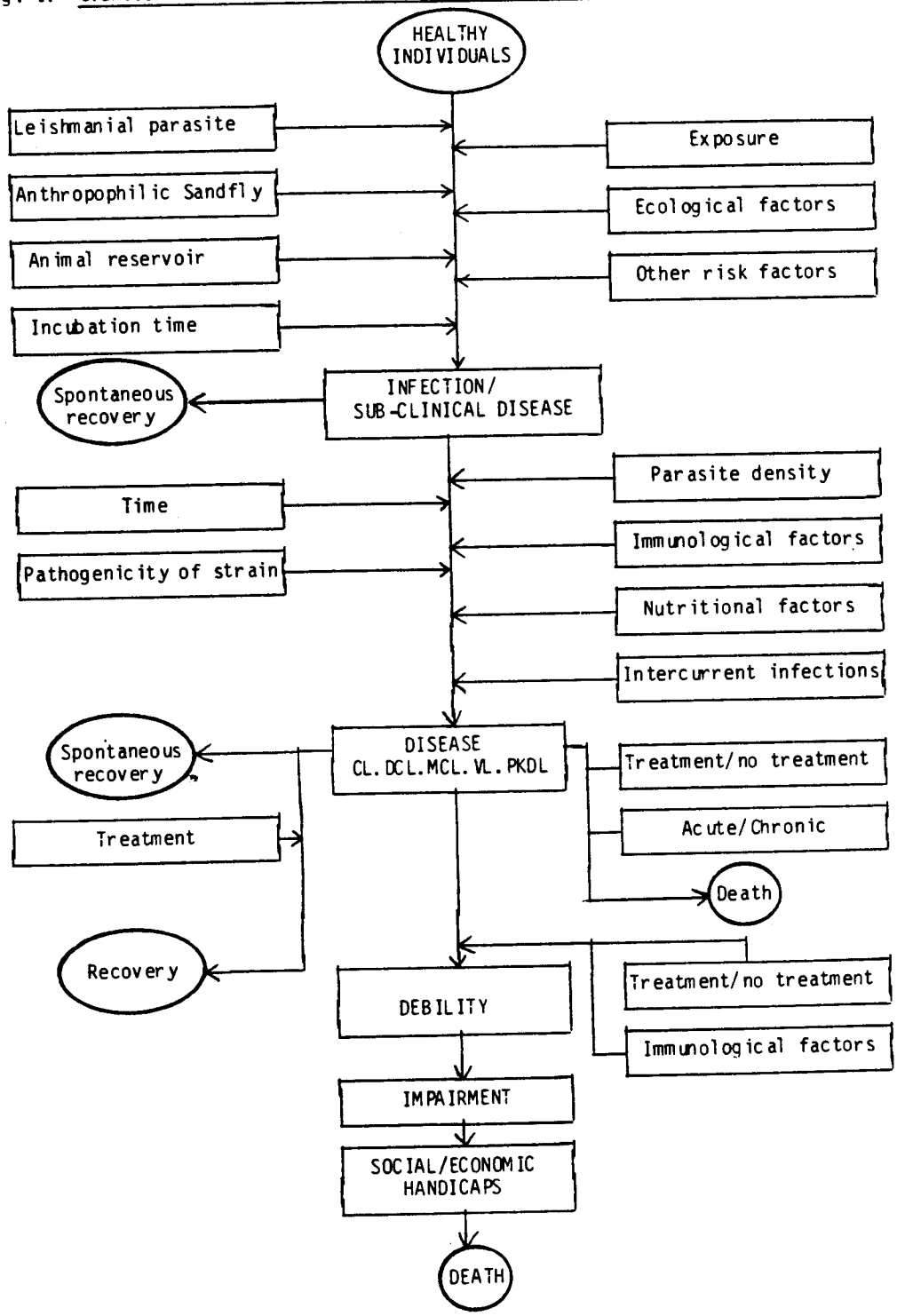
ii) General health status of the community (community diagnosis).

iii) Perception on sources and modes of acquisition of leishmanial infection and attitudes towards such modes.

iv) Beliefs and practices about leishmaniases.

v) Social and community infrastructural aspects of the population including occupations and services.
Patterns of behavior of:

Fig. I. OVERVIEW OF LEISHMANIASIS INFECTION AND DISEASE PATHWAYS



(1) sub-clinical infection carriers,
(2) acute cases, and
(3) chronic cases.

vi) General comprehension level about health and disease and prevention and control, and the use of any health facilities. The idea of risk factors in leishmaniasis. Social interactions in the community.

vii) If resettlement schemes, migrant workers or nomadic populations are involved, examine three basic levels, e.g., at point of origin, en route, and at final destination; and duration of movements, frequency, etc.. Recreational and leisure patterns in the community as may be related to leishmanial transmission and its impact and effects.

viii) Possible influence of leishmaniasis on educational attainment, development and motivation of the community.

ix) Influence of leishmaniasis on household activities, e.g., child care, cooking, backyard farming productivity, etc..

d) Economic factors

The following economy-related issues need to be examined in relation to the leishmaniases:

i) Sources of income in the community and employment patterns.

ii) Ownership of land and other assets.

iii) Nomadic populations and sources of income/survival and productivity.

iv) Access to resources, e.g., hunting, fishing, gathering.

v) Agricultural patterns in the community including schemes for mechanization, commercial enterprises, etc.

vi) Colonization schemes, forestation and forest clearance activities, irrigation schemes and other development projects in the area.

vii) Local political and economic structure.

viii) Location and distribution of houses and their design.

ix) Domestic animals, livestock and other animals - distribution.

x) Existence of temporary and permanent labor pools.

xi) Individual treatment costs for leishmaniasis.

xii) Loss of time at school/work/home at different levels of disability/morbidity associated with the leishmaniases.

xiii) Associated losses in income/revenue and savings and investment opportunities.

xiv) Hospitalization costs.

xv) Costs of preventive care.

xvi) Costs associated with animal reservoirs and their control or elimination.

xvii) Costs of efforts at disease control in the community.

xviii) Priority given to leishmaniases by:
i) local physicians
ii) Health Department
iii) Ministry of Health

Developmental considerations and discussion

For developing countries, which constitute about 75% of the global population (or 'Less-developed countries', or the 'Third World') "development" is the key objective and is usually thought of in terms of planned intervention. Major obstacles in the path of development include widespread and wide varieties of parasitic diseases frequently exacerbated by malnutrition and other health conditions. The leishmaniases are a typical and important example.

Disease control with the intention of producing decreased morbidity, decreased mortality, and general economic development, is considered necessary to improve the "quality of life." The links between disease and poverty, including the idea that people are sick because they are poor and become poorer because they are sick, also appear logical.

If endemic diseases such as the leishmaniases debilitate the population and eventually deplete the labor force of its vitality, they constitute barriers to progress. Therefore, it is widely held that public health interventions are prerequisites for economic development, implying that poverty can be prevented by disease control. However, careful thought should also be given to possible negative aspects of such interventions. For instance, as learned from the example of successful malaria control in Sri Lanka, the implications of decreased mortality, increased life expectancy, and the resultant lowering of per capita income should all be considerations. In fact, despite exceptional decline in fertility and improvement in family planning and health, Sri Lanka's GNP has not had a significant boost. The arguments, in this case, have been that population density and other economic factors have added to the inadequacies of simplistic considerations.[6]

On the other hand, the consideration of development, developmental projects and macrodevelopmental schemes and their impact on the leishmaniases are of increasing urgency. Massive internationally funded

schemes of various types are now rampant in various parts of the tropical world. Water resource development schemes or large dam construction projects, or others associated with deforestation or reforestation; migration; resettlement; or road building, usually cause widespread ecological disturbances and communities are subjected to significant changes in their biological, physical or socio-cultural environment. Whatever are the specific attributable factors, exacerbation of the leishmaniases has been considered as a by-product.

We have, today, very little knowledge of the precise impact of developmental projects on parasitic diseases including the leishmaniases. We have even a lesser understanding of the possible mechanisms involved in the effect of leishmaniasis on behaviour or effect on learning capacity, development and work efficiency. More reliable data on prevalence and incidence is needed in relation to infection and disease, with precise and usable information on vectors and reservoirs in relation to their habitats, as well as a better understanding of traditions, customs and practices in relation to the disease in the community.

Information to be provided to the ministries and planners in the country, should be shown in the context of the communities' needs and demands, along with the essentials for intervention, and the impact on development, short term and long term. Every macrodevelopment project must have a component which considers all factors in relation to leishmaniasis if prevalent in the community. Practical, feasible, sustainable approaches to prevention and control need to be identified through reliable research findings. There is a great need for input from the affected communities, with their active involvement and their in depth enlightenment towards a more effective role in the overall process of intervention.

Available technology, whether for more sensitive diagnosis, community surveillance or epidemiological methodology, needs to be exploited and applied; costs and benefits are of prime importance. Useful information from various disciplines attacking the problem of leishmaniasis could be the key contribution toward the elimination of this infection as an obstacle in the path of development.

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