Visceral leishmaniasis and its control in Bangladesh*

M. Elias,1 A.J.M. Mizanur Rahman,2 & N.I. Khan3

Visceral leishmaniasis, which is also known as kala-azar, reappeared in Bangladesh during the 1980s, approximately 7–8 years after large-scale use of DDT had been abandoned by the malaria eradication programme in the country. Pabna, Mymensingh and Rajshahi were the regions most affected with kala-azar. The article presents a historical review and information about the present status of leishmaniasis in Bangladesh together with control strategies and a proposed plan of operation.

Introduction

Visceral leishmaniasis (kala-azar), if left untreated, has a high mortality rate (6, 10). In the territory that corresponds to present-day Bangladesh, the disease was an important public health problem during the pre-malaria eradication period in the 1950s (2), but, during the 1960s, it almost disappeared as a result of malaria control activities involving the widespread use of DDT residual spraying. A resurgence of the disease, including post-kala-azar dermal leishmaniasis (PKDL), occurred, however, in several parts of the country during the late 1970s when large-scale use of DDT ceased (5, 7).

Although there have subsequently been reports of kala-azar in several areas of Bangladesh (1, 3, 5, 7, 8), little information is available about the outbreaks because the surveillance and reporting systems in the country are inadequate. Here, we present a review of the occurrence of visceral leishmaniasis in Bangladesh, covering both the past and present-day situations, and describe possible control strategies together with a proposed plan of operation.

Kala-azar during the pre-malaria eradication period

Although several epidemic outbreaks of kala-azar occurred in Bangladesh during the pre-malaria eradication period, reliable information is very rare. Before India gained independence in 1947, kala-azar surveys were carried out mainly in the then provinces of Assam, West Bengal, and Bihar. However, at that time the province of East Bengal, which corresponds to present-day Bangladesh, was also endemic for kala-azar (10).

In 1950, Gramiccio & Sacca (2), in the course of a malaria control campaign in East Pakistan, also studied the incidence of kala-azar in the country and took steps that led to its eventual control by introducing a programme of DDT residual house spraying, similar to that employed for malaria control, at Iswarganj thana in Mymensingh district. From January to July 1950 in Iswarganj 8.35% of the children below 15 years of age were positive for kala-azar by the aldehyde test, and the average size of the enlarged spleens of kala-azar test-positive children was 2.4 on the Hackett scale. Furthermore, in 41% of the families more than one person was infected with kala-azar. The distribution of kala-azar cases by age for the study children was as follows: ≤ 5 years, 62; 6–10 years, 102; and 11–15 years, 112.

Kala-azar during and after the malaria eradication period

With the launching of DDT residual house spraying by the malaria eradication programme during the 1960s in East Pakistan, visceral leishmaniasis almost disappeared from the country.

For example, Khan reported that only about 10 cases of PKDL were admitted to the Institute of Postgraduate Medicine and Research (IPGM and R) Hospital, Dhaka, from 1973 to 1976 (4). Most of these patients had a definite history of kala-azar, and scrapings for Leishmania donovani were positive in seven cases. Islam reported on two patients with kala-azar who were admitted to Sher-e-Bangla Medical College Hospital, Barisal district (3).

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Rahman & Islam studied 218 suspected cases of kala-azar admitted to the IPGM and R Hospital, Dhaka, from different parts of Bangladesh from 1968 to 1970 and from 1973 to 1980, and confirmed that 59 of them had kala-azar based on positive demonstration of *L. donovani* in tissue specimens; of 41 patients with suspected skin lesions, six were confirmed as having PKDL (7). The region or place of residence of 34 of the 59 patients was as follows: Sylibet (1), Mymensingh (2), Tangail (1), Pabna (6), Dhaka (12), Comilla (6), Jessore (1), Barisal (2), Patuakhali (1), and Noakhali (2).

Although cases of kala-azar have not been frequent since the 1960s in the country, a few patients with visceral leishmaniasis and PKDL have occasionally been reported, and an epidemic outbreak occurred at Shahjapur upazila (subdistrict) in Sirajganj district (Pabna region) in 1980–81 (see Table 2). The age and sex distributions of patients with kala-azar who showed strongly positive aldehyde tests in this outbreak are shown in Table 1. *L. donovani* was isolated from some of the patients and grown in NNN media in the Parasitology Department of the National Institute of Preventive and Social Medicine (NIPSOM). Sera from the kala-azar patients were also analysed by counter-immunoelectrophoresis (CIE) and indirect haemaggulination (IHA) methods (5). The results indicated that both methods are useful for the immuno-epidemiological surveillance of kala-azar: CIE for the identification of individuals infected with the clinical disease and IHA for the detection of the "background" of exposure.

Spraying the affected area with DDT (1 g/m²) as part of a malaria control programme in July 1981

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**Table 1: Age and sex distributions of patients with kala-azar who exhibited strongly positive aldehyde tests, Shahjapur upazila, Bangladesh, 1981**

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–5</td>
<td>20</td>
<td>17</td>
<td>37 (35.6)*</td>
</tr>
<tr>
<td>6–10</td>
<td>18</td>
<td>18</td>
<td>36 (34.6)</td>
</tr>
<tr>
<td>11–15</td>
<td>8</td>
<td>3</td>
<td>11 (10.6)</td>
</tr>
<tr>
<td>16–20</td>
<td>5</td>
<td>0</td>
<td>5 (4.8)</td>
</tr>
<tr>
<td>≥21</td>
<td>10</td>
<td>5</td>
<td>15 (14.4)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>61 (58.7)</td>
<td>43 (41.3)</td>
<td>104 —</td>
</tr>
</tbody>
</table>

* Figures in parentheses are percentages.

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**Table 2: Results of the aldehyde, indirect haemaggulination (IHA), and counterimmunoelectrophoresis (CIE) tests conducted on suspected cases of kala-azar from 1980 to October 1985 in Bangladesh**

<table>
<thead>
<tr>
<th>Year</th>
<th>Place</th>
<th>No. tested</th>
<th>No. strongly positive</th>
<th>No. tested</th>
<th>No. positive*</th>
<th>No. tested</th>
<th>No. positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>Shahjapur (Sirajganj)*</td>
<td>183</td>
<td>120</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1981</td>
<td>Shahjapur (Sirajganj)</td>
<td>155</td>
<td>104*</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1982</td>
<td>Shahjapur (Sirajganj)</td>
<td>57</td>
<td>37*</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1983</td>
<td>Shahjapur (Sirajganj)</td>
<td>6</td>
<td>3</td>
<td>41</td>
<td>14</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Fulbaria (Mymensingh)</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>IPGM and R Hospital</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1984</td>
<td>Shahjapur (Sirajganj)</td>
<td>Unknown</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Faridpur (Pabna)</td>
<td>Unknown</td>
<td>17</td>
<td>—</td>
<td>—</td>
<td>—</td>
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</tr>
<tr>
<td></td>
<td>Fulbaria (Mymensingh)</td>
<td>Unknown</td>
<td>17</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Trisal (Mymensingh)</td>
<td>Unknown</td>
<td>9</td>
<td>—</td>
<td>—</td>
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<td>—</td>
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<tr>
<td></td>
<td>Mymensingh Medical</td>
<td>—</td>
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<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>College Hospital</td>
<td>Unknown</td>
<td>1*</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1985</td>
<td>Shahjapur (Sirajganj)</td>
<td>Unknown</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td></td>
<td>Shujanagar (Pabna)</td>
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<td>19</td>
<td>—</td>
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<td></td>
<td>Chalmohor (Pabna)</td>
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<td>155</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Faridpur (Pabna)</td>
<td>Unknown</td>
<td>35</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Fulbaria (Mymensingh)</td>
<td>Unknown</td>
<td>39</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Trisal (Mymensingh)</td>
<td>Unknown</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Bhaluka (Mymensingh)</td>
<td>Unknown</td>
<td>7</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Mymensingh Medical</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>College Hospital</td>
<td>Unknown</td>
<td>3*</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Kalmakanda (Natorokona)</td>
<td>Unknown</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Godagari (Rajshahi)</td>
<td>Unknown</td>
<td>6</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

* Positive titre range, 1: 64 to 1: 2048.
* Names in parentheses are regions or district.
* One case was parasitologically confirmed by isolation in NNN medium.
* Two cases were confirmed by examination of samples of bone marrow.
* Confirmed by spleen puncture and by examination of samples of bone marrow.
reduced the density of sandflies and the incidence of kala-azar.

Cases of kala-azar have also been reported in several other areas of the country, including the Mymensingh and Rajshahi regions (Table 2). Also, a map showing the geographical distribution of kala-azar cases in Bangladesh in 1968–80 and 1981–85 is given in Fig. 1. Many of the cases of kala-azar and PKDL, nevertheless, remain undetected because of the lack of laboratory facilities, trained manpower,

Fig. 1. Map showing the distribution of cases of kala-azar in the 21 regions of Bangladesh from 1968 to 1980 and from 1981 to 1985 (figures enclosed in circles are the number of cases for 1968–80, and those in triangles the number for 1981–85).
and an adequate reporting system, as well as a low level of awareness about the disease among medical professionals working in peripheral areas of the country.

**Entomological surveillance and vector identification**

Few entomological surveys of sandfly populations have been carried out in Bangladesh. Gramiccia & Sacca (2) and Nasiruddin (9) reported the composition of the sandfly fauna and the effect on this of DDT spraying in Islwanganj upazila, Mymensingh region. The following species of sandflies were recorded: *Phlebotomus argentipes*, *Sergentomyia africana*, *S. theodori*, *S. shortii* (=*S. squamipleuris*) and *S. babu* (=*S. minuta*) and found that DDT spraying was effective against these sandflies. Also, a survey carried out by Ahmed & Ahmed in Shahjadpur, Sirajganj district, from June to August 1981 identified the following sandflies: *P. argentipes*, *S. malarbarica*, and *S. minuta*.

In Bangladesh, no effort has been made to implicate sandflies as vector(s) of leishmaniasis; however, *P. argentipes* is a recognized vector of kala-azar in India (11), and in Bangladesh this species occurs in areas where cases of kala-azar have been recorded.

**Methods**

**Control strategies**

Various control strategies for visceral leishmaniasis are available. The particular approach selected should be adapted to meet local situations after thorough ecological and epidemiological studies of the vectors, hosts, parasites and the landscape have been made to define the type of the disease, its prevalence, epidemiological features and geographical distribution. The information obtained should be compared with the most recent census data in order to gain an estimate of the population at risk. If insufficient baseline information is collected, control measures can be expected to fail (6, 10). The following strategies for the control of leishmaniasis could be adapted for use in Bangladesh:

- Collection (by active and passive detection) of baseline information on the occurrence of kala-azar and/or PKDL, including hospital and health centre records, in each of the 64 districts of the country.

- Delineation of the areas affected with kala-azar into the following strata: stratum I, areas where a number of kala-azar cases occurred at approximately the same time; stratum II, areas where kala-azar cases occur sporadically; and stratum III, areas where kala-azar cases are not present and have not been reported in the recent past.

- The composition of the vector fauna should be determined based on samples taken in each of the 64 districts; longitudinal entomological studies should be set up in selected fixed capture stations to determine the bionomics and vectorial capabilities of the sandflies and to check the impact of control measures.

- Different serological diagnostic techniques should be evaluated in, for example, the Parasitology Departments of the NIPSOM or the Institute of Epidemiology, Disease Control and Research (IEDCR), and services for the immunoenzymoepidemiological surveillance of kala-azar should be strengthened throughout the country.

- A mechanism should be developed for the detection of cases of leishmaniasis, including epidemiological and entomological surveillance, and for their rapid treatment, together with the introduction of insecticidal spray operations.

- Communities should be involved in sandfly control through the primary health care approach, using equipment and spraying skills already available for agricultural purposes; cracks in the mud walls of houses should be repaired and rubbish removed from around houses to reduce the number of sandfly breeding sites.

- Where insecticides are used to control malaria vectors, the impact of such campaigns on sandfly vectors and on the transmission of visceral leishmaniasis should be assessed simultaneously.

- Field health personnel as well as community leaders and volunteers should be trained, using the primary health care approach, to recognize clinical kala-azar and, to a lesser extent, PKDL.

- Better reporting and recording systems should be set up by modifying the appropriate organizational components of the health infrastructure.

- Health education campaigns should be strengthened so that the public is aware of how kala-azar is transmitted and also about PKDL.

- Continuous monitoring and evaluation should be carried out to determine the effect of the above-mentioned measures on the incidence of the disease, to assess their cost-effectiveness, and to adjust control strategies, if necessary.

- Since specialized training programmes on the epidemiology, parasitology and entomology of visceral leishmaniasis are not available in Bangladesh, the global and/or intercountry regional training prog-
rammes of WHO or bilateral agencies should be used to improve monitoring, evaluation, and research capabilities.

- A detailed plan of operation that includes the above-mentioned points should be made available for implementation, initially for a period of 2–5 years.

**Proposed plan of operation**

Before starting a control programme a countrywide assessment should be made of the epidemiology, parasitology, and entomology of kala-azar in Bangladesh; also, it should be established whether there is an animal reservoir of the disease in the country.

In areas where cases of kala-azar or PKDL occur sporadically, the epidemiological and parasitological investigations could be carried out by the upazila medical officers. The deputy civil surgeons and the civil surgeons of the respective districts could also participate in such investigations. Entomological investigations should be carried out by the district entomologists and entomology technicians.

In areas where the endemicity of kala-azar is relatively high, national investigation teams from the health directorate, including the NIPSOM and the IEDCR should take part in the epidemiological, parasitological, entomological, and zoonotic investigations.

**Kala-azar control programme activities**

In the control programme the activities outlined below should be carried out.

**Detection of cases of kala-azar and PKDL.** This activity should be carried out using the two approaches described below.

1. **Active case detection.** Active surveillance for cases could be carried out by health assistants or assistant health inspectors through house-to-house visits for regular systematic screening. In this way information could be obtained on clinically suspected cases of kala-azar including data on the duration of fever, the presence or absence of a grossly enlarged spleen, and any skin lesions that suggest PKDL. Care should be taken to avoid multiple reporting of cases. The medical officers of the respective upazila health complexes could then investigate and treat the cases. The aldehyde test and microscopic examination of blood films on glass slides to exclude malaria could be carried out at the upazila health laboratories, while immunodiagnostic tests and parasitological diagnosis (if serologically positive) could be performed at Dhaka or regional laboratories where such facilities are available. Health assistants and assistant health inspectors should be trained for 2–3 days at upazila health complexes to recognize clinically suspected cases of kala-azar and PKDL.

2. **Passive case detection.** The establishment of diagnostic facilities in the health centres of endemic areas is indispensable; for this purpose, passive case detection is useful for estimating the local prevalence of the disease and for detecting fluctuations in its incidence that may require special attention. Passive surveillance should be carried out by assistant health inspectors who could collect information from hospitals, dispensaries, and private medical practitioners. For this purpose, old and new cases would be reported separately. The value of the information gathered depends on a reliable reporting system.

**Treatment of kala-azar and PKDL.** The permanent availability of appropriate amounts of suitable drugs in the treatment centres is essential. Patients have to be encouraged to complete the course of therapy since incomplete treatment can lead to drug unresponsiveness and relapse. Standard drugs and dosages should be used to treat cases of kala-azar and PKDL and patients should receive the therapy as soon as possible after detection. Diagnosis should be based on clinical findings supported by parasitological or serological data, and individuals should be asked to attend treatment centres to undertake a course of therapy. Appropriate centres for this purpose are the hospitals, upazila health complexes and/or union-level health and family welfare centres, as well as temporary centres set up to deal with patients from remote villages. The voluntary services of local reliable private medical practitioners could also be used to treat patients with kala-azar or PKDL.

**Entomological surveillance.** Studies to determine the composition and population density of sandflies, their distribution, and resting habits should be carried out by entomologists from the district, divisional, and national headquarters of the health directorate and from NIPSOM/IEDCR. Efforts should be made to identify the vectors responsible and determine their bionomics and susceptibility level to insecticides. A limited number of longitudinal entomological studies of sandflies should be performed in selected fixed capture stations to discover their habits and habitats, including seasonal fluctuations. Furthermore, the district entomologists and entomology technicians currently serving in 26 of the districts could be assigned to carry out such investigations also in the remaining 38 districts until the appointment of suitable personnel in the latter.
Vector control by Insecticide spraying. Once the entomological investigations have been completed, the domestic and peridomestic breeding and resting places of the vectors should be sprayed with insecticide at the appropriate dose by the proposed responsible units of the Directorate of Primary Health Care and Disease Control.

Health education. Health educational programmes should be initiated well ahead of launching the control programme and should be continued as the latter progresses. The objectives of the health educational programmes should be to promote community participation in all activities related to prevention and control of visceral leishmaniasis and its vectors.

Evaluation of the control measures. At various stages during the programme, evaluations should be carried out to:
- determine the effect of the control measures on the incidence of the disease and on the vectors;
- assess its cost-effectiveness;
- and adjust the control strategies, if necessary.

Inter-country coordination. Kala-azar has been reported in the adjoining Indian state of West Bengal and also in parts of Nepal that border the Indian state of Bihar. Since there is a likelihood of population movements between Bangladesh, India, and Nepal, there should be coordinated effort between them to control visceral leishmaniasis.

Organization of the control programme. The NIPSOM and IEDCR in Dhaka should function as the national centre for the seroepidemiological diagnosis, entomological investigation, and training and applied research activities of the programme. Implementation of the parasitological and entomological surveillance and the control of kala-azar should be carried out, following appropriate reorganization of its services, by the Malaria and other Parasitic Diseases Control Unit of the Directorate of Primary Health Care and Disease Control under the Director General of Health Services.

Supervisory activities should be intensified at the divisional level especially by the assistant director (Disease Control) and by the divisional entomologist, and at the district level especially by the deputy civil surgeon and district entomologist. The upazila health and family planning officers, supported by the respective medical officer(s), health inspector(s) and assistant health inspector(s), should be made responsible for the overall execution of the control activities at the village level through health assistants.

A committee consisting of an epidemiologist, parasitologist, entomologist and an administrator/planner should be set up to formulate a detailed plan of operation for the kala-azar control programme in Bangladesh. The plan could be made initially for 2–5 years and include also details of logistic support and budgetary provisions.

Résumé

Incidence de la leishmaniose viscérale et lutte contre cette maladie au Bangladesh

Sans traitement, la leishmaniose viscérale est souvent mortelle. Au Bangladesh, où la maladie était un problème de santé publique majeur dans les années 50, elle a pratiquement disparu suite à l'emploi massif du DDT dans le cadre des programmes d'éradication du paludisme au cours des années 60. Récemment, elle y a fait sa réapparition, mais nous ne disposons que de peu de données fiables en raison de l'insuffisance des systèmes de surveillance et d'information. Nous présentons ici l'histoire de la leishmaniose viscérale au Bangladesh et nous exposons les grandes lignes de quelques stratégies de lutte et un plan de campagne pour leur mise en œuvre.

Avant 1947, le territoire qui s'appelle aujourd'hui le Bangladesh ne figurait pas parmi les régions de l'Inde britannique où sévissait la leishmaniose viscérale, car à cette époque les enquêtes se concentraient surtout sur les provinces de l'Assam, du Bengale-Occidental et du Bihar. Une enquête menée entre janvier et juin 1950 au thana d'Iswarganj, dans le district de Mymensingh au Pakistan oriental, a cependant révélé que l'épreuve à l'aldehyde formique donnait des résultats positifs chez 83,5% des enfants de moins de 15 ans et que la taille moyenne de leur rate hypertrophiée était de 2,40 sur l'échelle de Hacket. On a également observé que dans 41% des familles de la région, plus d'une personne était atteinte par la maladie.

Le pays avait été presque totalement débarrassé de la leishmaniose viscérale grâce aux efforts d'éradication du paludisme entrepris dans les années 60. Mais à la fin des années 80 et dans les années 70, le retour de la maladie a été signalé et le diagnostic en a été confirmé par l'identification de Leishmania donovani dans des prélèvements de tissu chez 59 des 218 cas supposés qui avaient été hospitalisés. Il s'est avéré que 8 des 41 malades présentant des lésions cutanées suspectes souffraient de la leishmaniose cutanée post-kala-azar. L'hospitalisation de quelques autres cas a été signalée.

Des études entomologiques ponctuelles ont permis de constater la présence au Bangladesh de plusieurs espèces de phlébotomes, à savoir: *Phlebotomus argentipes*, *Sergentomyia malarbaricus*, le groupe de *S. minute*, *S. africana*, *S. theodori*, *S. shorttii* (=*P. squamipleuris*) et *S. babu* (=*S. minutus*). On sait que *P. argentipes*, qui vit dans des régions du Bangladesh où des cas de leishmaniose ont été signalés, est un vecteur de la maladie en Inde.

L’examen de plusieurs stratégies de lutte, d’un projet de plan de campagne et des détails du programme de lutte est en cours.

References


