A RECENT UPDATE OF SCHISTOMIASIS MANSONI ENDEMICITY AROUND LAKE RWERU

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ABSTRACT

Background: Schistosomiasis remains a global public health challenge with an estimated 200 million cases reported each year. In Rwanda, the prevalence of schistosomiasis was recently examined by a countrywide mapping conducted by the Neglected Tropical Disease (NTD) Control Programme of the Rwandan Ministry of Health in partnership with The Access Project. Unfortunately, that study failed to consider one area of endemicity -- Lake Rweru, located in Bugesera District, Eastern Province, Rwanda. This screening aimed to evaluate Lake Rweru and its environs in order to determine next steps for disease control.

Methods: The lake's shore inhabitants, including children and adults, were invited to be screened for intestinal schistosomiasis. The stool examination was performed by Kato-Katz technique.

Results: A total of 270 children and adults were parasitologically screened. Fifty seven (57) cases of schistosomiasis mansoni were confirmed (21.1%). The highest proportion of S. mansoni infection was observed at Mazane Island (30.1% of 93 island inhabitants screened).

Conclusion: The present results confirm that Lake Rweru is a significant source of S. mansoni infection in the country. We recommend further future investigations in order to know the true disease prevalence. While the mass de-worming campaign against schistosomiasis in addition to soil-transmitted helminthiasis is being regularly conducted by the Ministry of Health in all endemic areas, the population surrounding Lake Rweru should receive special attention.

Keywords: Schistosomiasis mansoni - endemicity - Lake Rweru - Bugesera - Rwanda

INTRODUCTION

Schistosomiasis remains an important public health threat globally with an estimated 200 million cases reported each year [1]. However, as of 2005, 85% of the cases reported annually occur in sub-Saharan Africa [2, 3], mostly among poor people who live in remote areas, without access to health services, safe water, sanitation, and education [4].

Schistosomiasis is caused by worms of the genus Schistosoma (trematode worms). The five species infecting humans are Schistosoma mansoni, S. haematobium, S. japonicum, S. mekongi and S. intercalatum, and transmission cycle requires specific freshwater snails as intermediate hosts [1, 5]. These worms live in the small blood vessels associated with the liver, intestine and bladder (depending on the species) and cause extreme pathology, morbidity and even death in individuals with heavy, chronic infections. The only human schistosome species prevalent in Rwanda, Schistosoma mansoni is most common in Africa but occurs in the Americas as well [6].

The situation of Schistosomiasis in Rwanda was recently updated by the disease countrywide mapping by the Rwandan Ministry of Health in partnership with the Columbia University’s The Access Project. The main endemic areas for schistosomiasis were found to be Lakes Ruhondo, Bulera, Muhazi and Kivu [7]. The mapping was school-based and followed the WHO guidelines for helminthiasis control [8].
A recent update of schistosomiasis mansoni endemicity

The Lake Rweru is located in the South-East of Rwanda (Bugesera District), at an altitude of 1350 m. The total surface area of Lake Rweru covers some 100 km², of which 20 km² lie in Rwanda and 80 km² in Burundi. This shallow lake is part of the Upper Akagera Lakes Complex, and has a shoreline of some 76 km. The mean depth is around 2.1 m with a maximum of 3.9 m [9]. Up to recently, the Rwandan Ministry of Health had no data from the Lake Rweru area indicating the endemicity of schistosomiasis. During the nationwide prevalence survey on Soil-transmitted helminthiasis and schistosomiasis carried out from 2007 to 2008, six primary schools located in Bugesera district have been randomly selected and surveyed. Three of those schools were closely located to other different lakes and Lake Rweru surroundings were not represented in the study [7].

Before the present screening being undertaken, few cases were routinely diagnosed among outpatients at Nzangwa Health Center located at approximately 10 km from the Lake Rweru. After the routine detection, a joint mission of laboratory technicians from the health center and Nyamata District Hospital performed a stool microscopy for one hundred lake-shore inhabitants from whom four cases were detected. This observation has raised more attention and alerted the district health authorities and the Ministry of Health’s NTD control Program thereafter for undertaking a more reliable survey. The screening aimed at confirming the focus in order to determine next steps for disease control.

METHODS

Study area and population

The study area was the Lake Rweru region and participants were all the lake-shore inhabitants willing to be tested for intestinal schistosomiasis. Few days before the survey team visit the community health workers in the area were contacted and asked to inform the population.

Study design

The survey was a descriptive and cross-sectional study conducted in the early November 2009.

Inclusion criteria

Children aged at least two years and adult individuals from villages surrounding the Lake Rweru.

Exclusion criteria

Children under two years of age and all individuals not residing in the Lake surroundings.

Survey team, training and data collection

A 3-day refresher training for 12 laboratory technicians from 12 health centers of Bugesera District was anticipated and held at Nyamata District Hospital from 2 to 4 November 2009. Trainees were familiarized with laboratory diagnosis of schistosomiasis and intestinal worms using Kato-Katz method. For the last day, the half of trainees leaded by a senior trainer from the National Reference Laboratory (NRL) and a supervisor from the NTD Programme went to the Lake Rweru area to undertake stool samples collection among lake-shore inhabitants. The data collection took two days. The stool microscopy was performed at Nyamata health center.

The Screening was based on examining from each participant a single 41.7 mg Kato-Katz smear, prepared from a fresh stool sample and left to clear for 10-30 minutes [10-12]. The smear was examined in a systematic manner and the number of eggs of each species reported. Later, this number was multiplied by 24 to obtain the number of eggs per gram of faeces (epg). The Kato-Katz thick smear technique is the standard technique recommended by the World Health Organization (WHO) for the quantitative diagnosis of Schistosoma mansoni and other intestinal helminth infections [11].

Quality control

The consistency of microscopic results during the survey was verified for quality control. Each day during the survey, the senior laboratory technician (and trainer) from the NRL had to read at least 10% of the slides handled by each microscopist without prior knowledge of the results. In the case of any discrepancy, the slide was discussed by the survey team further slides were examined to avoid repeated errors.

Statistical analysis

Data were collected using a record book (register). Data entry and analysis was done using Epi Info 3.2.2.

Variables:

Demographic characteristics: age in years, sex and residence (cells/villages). The number of eggs was expressed in eggs per gram (epg) for S. mansoni, A. lumbricoides, T. trichiura and hookworm.

We calculated the proportion of persons with each of helminths mentioned above, a case was defined as a person with at least 1 egg in the faeces. Arithmetic mean was used to calculate mean intensity. The intensity of S. mansoni infection was classified according to the WHO recommended thresholds (light: 1-99 eggs per gram, moderate: 100-399 epg, heavy: ≥400 epg) [8].

Ethical considerations

The stool screening for schistosomiasis among the general population around Lake Rweru intended to collect additional data to the national mapping whose protocol was reviewed and approved by both Rwandan National Ethics Committee (RNEC) and the Columbia University’s Institutional Review Board (IRB). Before collecting samples, aims and procedures to be used to collect data were explained to...
participants, parents or guardians and community leaders including chiefs of villages and community health workers. The consent written in Kinyarwanda was obtained from the participants, children’s parents or guardians and assent was subsequently obtained from the children. Participants with S. mansoni infection were treated with Praziquantel 40 mg/kg body weight, single dose, while for other helminthic infections such as A. lumbricoides, T. trichiura and hookworm; a single curative dose of 400mg Albendazole was given.

RESULTS

A total of 270 individuals (children and adults) were screened. Fifty seven (57) cases of Schistosoma mansoni were confirmed giving a positivity proportion of 20.1%. Geographical distribution was much focalized with percentage of cases ranging from 1.6% to 30.1%. Only one case (1.6%) was detected at Mujwiri site while the proportion of positivity was 30.1% and 24.6% at Mazane and Nyiragiseke sites, respectively. The intensity of schistosomiasis mansoni was generally light (80.7%) while the mean intensity was 75.0. For other intestinal parasites (STHs), the positivity proportion was 33%, 22% and 12.2% for Hookworm, T. trichiura and A. lumbricoides, respectively.

Table 1: Helminth infections detected in the studied population (N=270)

<table>
<thead>
<tr>
<th>Parasite</th>
<th>n</th>
<th>% (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schistosoma mansoni</td>
<td>57</td>
<td>21.1 (16.4-26.5)</td>
</tr>
<tr>
<td>Ascaris lumbricoides</td>
<td>33</td>
<td>12.2 (8.6-16.7)</td>
</tr>
<tr>
<td>Trichuris trichiura</td>
<td>60</td>
<td>22 (17.4-27.7)</td>
</tr>
<tr>
<td>Hookworm</td>
<td>89</td>
<td>33 (27.4-38.9)</td>
</tr>
</tbody>
</table>

Table 2: Distribution of S. mansoni cases by site and age category

<table>
<thead>
<tr>
<th>Visited sites</th>
<th># of participants by age category*</th>
<th>S. mansoni +</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nyiragiseke</td>
<td>&lt; 5 years  6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5-16 years 37</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>&gt; 16 years 71</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Total  114</td>
<td>28 (24.6%)</td>
</tr>
<tr>
<td>Mazane Islande</td>
<td>&lt; 5 years  3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5-16 years 49</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>&gt; 16 years 41</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Total  93</td>
<td>28 (30.1%)</td>
</tr>
<tr>
<td>Mujwiri</td>
<td>&lt; 5 years  0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5-16 years 26</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&gt; 16 years 37</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total  63</td>
<td>1 (1.6%)</td>
</tr>
<tr>
<td>Total</td>
<td>&lt; 5 years  9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5-16 years 112</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>&gt; 16 years 149</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Total  270</td>
<td>57 (21.1%)</td>
</tr>
</tbody>
</table>

Table 3: Intensity of S. mansoni infection (mean eggs per gram faeces, n=57)

<table>
<thead>
<tr>
<th>Intensity category</th>
<th>EPG*</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean intensity (SD)</td>
<td>75.0 (89.8)</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>1-99</td>
<td>46</td>
<td>80.7</td>
</tr>
<tr>
<td>Moderate</td>
<td>100-399</td>
<td>10</td>
<td>17.5</td>
</tr>
<tr>
<td>Heavy</td>
<td>≥ 400</td>
<td>1</td>
<td>1.8</td>
</tr>
</tbody>
</table>

*EPG: Eggs per gram of faeces
DISCUSSION

The present investigation on intestinal schistosomiasis around Lake Rweru confirms the presence of *S. mansoni* infection with the proportion of infected individuals of 21.1%. This suggests probable high prevalence of the disease among the lake-shore inhabitants. Great spatial variation of infection detection was observed in the three visited sites. The proportion of infected individuals at each site was 30.1%, 24.6% and 1.6% at Mazane Island, Nyiragiseke Village and Mujwiri Village, respectively. Schistosomiasis occurs in focal pockets and is closely linked to the presence of water bodies that harbour susceptible species of snails. The spatial variation of the presence of infection around the same water body has also been observed elsewhere [7, 13, 14]. The highest proportion of infected individuals was observed among individuals living in close proximity to the lake (Mazane Island and Nyiragiseke Village) which is the only source of water for the community. Only one case of *S. mansoni* infection was diagnosed at Mujwiri, a place with piped water and where people are sensitized for respecting distances of 50m from the lake for environmental benefit according to the Environment Protection Law.

Several studies on schistosomiasis have tended to focus on school-age children and adults, with little or no emphasis on pre-school children, and where pre-school children are part of the study, information about them was often subsumed [15,16]. The results of this survey have shown that pre-school children also harbour infection and are a source of transmission of schistosomiasis in endemic communities. From our observation and discussions with parents we have learnt that infection of pre-school children early in life was due to exposures through bathing in the lake by their mothers, while the older children would visit the lake for washing, fetching of water, bathing and swimming. Theses findings are consistent with the observations of the study conducted in Nigeria by Uwem Ekpo et al. [17].

The most recently published data from the Burundian side of Lake Rweru indicates this area as a highly endemic focus for *Schistosoma mansoni* infection [18].

For other parasitic infections (STHs), people were mostly infected by hookworm (33%) followed by *T. trichiura* (22%) and *A. lumbricoides* (12.2%). Previous data showed that hookworm was the predominant STH in the Eastern Rwanda (East Province) [7].

CONCLUSION

The present community-base survey provides important information on the status of schistosomiasis mansoni among the population around Lake Rweru and confirms that this area is a significant source of the infection in the country. We recommend further investigations in order to determine the true prevalence of this infection and to plan for disease control accordingly. Another option is to immediately undertake the mass education campaign for prevention along with the annual mass deworming and advocacy for safe water supply for the lake-shore population. The results show that pre-school children also harbour *S. mansoni* infection and are therefore also source of transmission in endemic communities. Although currently excluded from mass treatment programmes, provision for their inclusion in treatment programmes is imperative and should be considered.

Limitations of the study

Duplicate Kato-Katz smear from each individual is recommended for epidemiological surveys for good sensitivity but only one smear was prepared and examined for practical and logistical reasons. Duplicate smears would require additional time and budget which were not initially planned by the NTD Program.

Acknowledgements

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REFERENCES

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