An outbreak of schistosomiasis in travellers returning from endemic areas: the importance of rigorous tracing in peer groups exposed to risk of infection

Ola Blach1,2, Bhavan Rai1, Ken Oates3, Grant Franklin4, Steve Bramwell1

1Department of Urology, Raigmore Hospital (Radiology), Old Perth Road, Inverness IV2 3UJ, UK
2School of Medicine and Dentistry, University of Aberdeen, Aberdeen, UK
3Department of PH, Assynt House, Beechwood Park, Inverness IV2 3UJ, UK
4Acute Medical Admissions Unit, Raigmore Hospital, Inverness IV2 3UJ, UK
Address correspondence to Ola Blach, E-mail: ola.blach@nhs.net

ABSTRACT

Background Each year, schools across Scotland send their students on exchange programmes to Malawi. Between 2005 and 2009, 22.8% of Scotland’s new cases of schistosomiasis were from freshwater exposure in Malawi, with 41.5% diagnosed in 15–24 year olds. In January 2011, a 17-year-old male presented to our urology department with visible haematuria following freshwater exposure during a school trip to Malawi. He was subsequently diagnosed with urinary schistosomiasis.

Methods The potential involvement of other individuals from the trip prompted further public health enquiry. The school, public health department and education authorities were notified promptly and all individuals potentially exposed to Schistosoma haematobium were invited for screening.

Results All 21 participants of the exchange programme underwent serological screening. Thirteen tested positive for Schistosoma infection. Only two individuals displayed symptoms of schistosomiasis; the other 11 were asymptomatic.

Conclusions Infection rates, even following a limited exposure to S. haematobium, are high. The majority of seropositive cases may never have symptoms. Therefore, a history of foreign travel to endemic schistosomiasis areas should be sought from any young person presenting with visible haematuria and appropriate tests instigated. Schools should adopt policies forbidding activities involving freshwater exposure in Malawi. Effective public health measures must be set in place to trace and treat any other possible cases of exposure.

Keywords genitourinary diseases, population-based and preventative services, young people

Background

Schistosomiasis is a highly prevalent parasitic disease, estimated to affect more than 200 million people in over 70 countries. Endemic to sub-Saharan Africa, the Middle East, Southwest Asia and parts of South America, schistosomiasis is only ever diagnosed outside these zones when imported by non-immune travellers. Geographic distribution, by continent and country, of new cases of schistosomiasis identified in Scotland is illustrated in Tables 1 and 2, respectively.

The social and cultural links between Scotland and Malawi have been cultivated for over 150 years, dating back to the work of Scottish doctor and missionary explorer David Livingstone. Established in 2004, Scotland–Malawi Partnership was the first charity to bring together, under a single administrative umbrella, the many organizations and individuals engaged in fostering links between the two countries, and to encourage collaboration between Scottish and Malawian schools via student exchange programmes. A year later, in November 2005, the ‘Cooperation Agreement’ was
Table 1 Geographic distribution or new episodes of schistosomiasis identified in Scotland between 2005 and 2009

<table>
<thead>
<tr>
<th>Region</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>226</td>
<td>65.1</td>
</tr>
<tr>
<td>Not known</td>
<td>106</td>
<td>30.5</td>
</tr>
<tr>
<td>Asia</td>
<td>5</td>
<td>1.4</td>
</tr>
<tr>
<td>Middle East</td>
<td>4</td>
<td>1.2</td>
</tr>
<tr>
<td>Americas</td>
<td>3</td>
<td>0.9</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>347</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Reproduced as graphics with permission from Redman et al.2.

Table 2 Geographic distribution or new episodes of schistosomiasis identified in Scotland between 2005 and 2009 by country for Africa only for those episodes where a country was reported

<table>
<thead>
<tr>
<th>Country</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malawi</td>
<td>79</td>
<td>44.6</td>
</tr>
<tr>
<td>Uganda</td>
<td>44</td>
<td>24.9</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>8</td>
<td>4.5</td>
</tr>
<tr>
<td>South Africa</td>
<td>6</td>
<td>3.4</td>
</tr>
<tr>
<td>Nigeria</td>
<td>6</td>
<td>3.4</td>
</tr>
<tr>
<td>Tanzania</td>
<td>5</td>
<td>2.8</td>
</tr>
<tr>
<td>Angola, Burundi, Congo,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egypt, Ethiopia, Gambia,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ghana, Kenya, Mauritius,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rwanda, Sierra Leone,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somalia, Sudan, Swaziland,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>177</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Reproduced as graphics with permission from Redman et al.2.

signed between the governments of Scotland and Malawi, officially outlining key areas of cooperation between the two countries: civic governance, sustainable economic development, health and education.

Whilst the number of schools participating in the scheme increased more than 10-fold, the number of confirmed schistosomiasis cases in Scotland has reached its highest since 2002,2 with the majority of confirmed cases, 41.5% (47% females, 36% males), diagnosed in young adults, aged 15–24 (Fig. 1).

Case presentation

A 17-year-old Caucasian male presented to our urology department in January 2011 with a background history of painful visible haematuria, following an urgent referral from primary care. He reported seeing intermittent ‘droplets of blood within urine’ on two recent occasions in association with mild dysuria. His past medical history was unremarkable. Notably, however, he confessed to bathing in a muddy reedy area of Lake Malawi in July 2010 during a school cultural exchange visit and then feeling transiently ‘unwell’ upon return home. He was accompanied on the trip by 16 fellow students and 4 members of staff.

Physical examination was unremarkable, as were full blood count and urea and electrolytes. Urine dipstick was positive for blood +++ and protein +, while microscopy, cultures and sensitivities confirmed the presence of erythrocytes and absence of any bacterial growth. Infectious mononucleosis and chlamydia tests were negative. The subsequent ultrasound revealed an apparent irregular thickening of the bladder base, extending to the left side for a distance of 2–3 cm and a normal upper urinary tract. The cystoscopic appearances in the bladder were that of severe inflammation around little white blobs reminiscent of parasitic eggs trapped in the bladder mucosa following the host’s granulomatous response.

Given the patient’s positive history of foreign travel to an area endemic for *Schistosoma haematobium*, a clinical diagnosis of schistosomiasis was provisionally made and subsequently confirmed by a positive Schistosoma serology. The weak positive result of enzyme-linked immunosorbent assay was consistent with the terminal urine being negative for presence of ovocytes and suggestive of a mild schistosomiasis infection following a very limited exposure to the parasite.

Discussion

Main findings of this study

It was established that 17 pupils and 4 staff who took part in the school trip to Malawi in June/July 2010 were exposed to freshwater during a canoeing trip on Lake Malawi organized by a private adventure company. All the individuals concerned were notified by letter of the possibility of exposure to schistosomiasis and advised to contact their GP for serology screening. A question and answer information leaflet on schistosomiasis was also enclosed.

GPs were advised to reassure the patients with negative serology and to take stool and 24-h urine samples from those who screened positive for *Schistosoma* for ova detection; furthermore, positive cases were to be referred to a named local consultant physician, for coordination of subsequent treatment.

Finally, the Directors of Education at Highland Council and Argyll and Bute Council were informed of the situation along with the coordinator of the Scotland–Malawi
Partnership. Discussions are ongoing about the potential risks of schistosomiasis and the need for a universal schools policy, which prohibits paddling or swimming in any freshwaters during trips to endemic areas.

During the course of the enquiry, all 21 participants of the exchange programme responded to the notification letters (100% recall) and subsequently underwent serological screening. Of those, 13 tested positive for \textit{S. haematobium} infection. Only two individuals (the index and one other case) were symptomatic; the other 11 displayed no symptoms suggestive of infection.

Ten patients were referred to a designated infectious disease consultant at Raigmore Hospital, with the other three seen by specialists nearer to where they lived. All 13 patients were successfully treated with two doses of Praziquantel.

The issue of \textit{S. haematobium} infection in travellers returning from the endemic areas was highlighted nationally—a direct result of the close cooperation between the NHS Highland Public Health department and Health Protection Scotland (HPS), Highland Council and SMP. Relevant authorities were informed about the need for changes in the advisory guidelines, with respect to prevention of schistosomiasis. A new advisory section of the SMP guidance for travellers to Malawi was drafted and agreed with HPS.

\textbf{What is already known on this topic}

Three species of Schistosoma—\textit{baematobium}, \textit{mansi} and \textit{japonicum}—account for the majority of schistosomiasis diagnoses in humans; however, only \textit{S. baematobium} causes predominantly urinary tract symptoms.

Humans become infected through direct contact and breaching of the \textit{unbroken} skin barrier by free-living freshwater cercariae of \textit{S. baematobium}. The symptoms of schistosomiasis are attributable to the host’s granulomatous response to the eggs deposited in the bladder mucosa and not the adult worms, around which no clotting or inflammation occurs. The spectrum of reported symptoms may range from a swimmer’s itch, subsequent to cercarial skin penetration, through Katayama fever, coinciding with the onset of oviposition, to visible haematuria and terminal dysuria as seen in chronic urinary schistosomiasis, thus providing a reflection of the intensity, duration, activity and focality of \textit{S. baematobium} infection.

Immunological testing is an important diagnostic and epidemiological tool, but finding terminally spined eggs in urinary sediment remains the bedrock of diagnosis, except in very light infection and chronic inactive urinary schistosomiasis, in which egg excretion is uncommon and serologic, radiographic and cystoscopic diagnoses are all superior.

In the light of the long-established link between \textit{S. baematobium} and bladder cancer (Fig. 2), predominantly squamous cell carcinoma, and the ever-increasing number of schools participating in cultural exchange programmes, raising public awareness of the risks of \textit{S. baematobium} infection has never been more important.

Schistosomiasis is a named target for control by UNICEF–UNDP–World Bank–WHO Special Programme for Research and Training in Tropical Diseases. All the positive episodes diagnosed in the laboratories in Scotland must be, by law, reported to HPS and communicated to local public health services. The potential involvement of more individuals from the trip was a cause for concern and prompted further public health enquiry.
The study demonstrates that infection rates are high (with 13 patients out of 21 tracing positive) even following a very limited exposure to *S. haematobium*, and that the majority of seropositive cases may never have symptoms. It therefore cannot be safely assumed that any asymptomatic traveller returning from an area endemic for *S. haematobium* is free from infection.

The case also raises the question of the significance of positive serology in an asymptomatic individual. While chronic urinary schistosomiasis has been shown to increase the risk of bladder cancer, no association has yet been found between transient, low-grade *S. haematobium* infection and any significant health problems in later life. A long-term cohort study could potentially address those questions; however such trial would likely be economically unfeasible and ethically questionable.

Following the success of the many malaria control programmes, the possibility of implementing a similar strategy for schistosomiasis control, such as administration of a single dose of Praziquatel to all returning travellers from endemic areas, was considered. However, the potential feasibility and effectiveness of such a scheme is questionable, due to the lack of apparent benefit from early Praziquatel treatment (10–15 days post-exposure) in the asymptomatic travellers infected by *S. haematobium*, as reported by Grandiere-Perez *et al.* Therefore, the primary focus of any prevention programme should be on the education and communication of the risks of schistosomiasis.

**Limitations of this study**

The number of Scottish schools participating in the student exchange schemes with Malawi has been on the rise in the last decade with, on average, 2–3 delegations of students from the local secondary schools in the Highlands partaking each year. One could point out, therefore, the value of a wider screening programme, involving all the children from the index school and other institutions in the region, who travelled to Malawi and had freshwater exposure, either recently or in the past.

The findings of this study are, therefore, limited to only a sample of the total population at risk of infection with *S. haematobium*. Nevertheless, establishing the true incidence of schistosomiasis has never been the goal of this study, as such data are available to the public through HPS. Although it might be worthwhile to expand the screening in the future to include all retrospective and prospective cases, prevention through education should remain our priority.

**Conclusions: take-home messages**

The case highlights the gaps in knowledge and awareness among the general public, schools and authorities of the risk of schistosomiasis from freshwater exposure in Malawi. It is our belief that communicating and implementing the following key messages will help prevent any unnecessary future exposure to *S. haematobium* of teenagers travelling to schistosomiasis endemic countries.

- **Education authorities**: adopt a clear policy for schools participating in cultural exchange programmes to Malawi outlining the risk of schistosomiasis and forbidding exposure to freshwater through swimming or paddling.
- **Public health services**: provide appropriate information materials which communicate the risks of exposure to ANY fresh, untreated water in ALL the areas endemic to Schistosoma spp., specifically targeting the high-risk groups, including the participants of school cultural exchange programmes.
- **General practice**: be aware of the need for serology screening in asymptomatic individuals with a history of freshwater exposure in high-risk areas in preference to urine
microscopy which may not detect ova in low-grade infection or limited exposure;

• Urology services: a history of foreign travel and possible exposure to schistosomiasis in patients with visible haematuria should be elicited and blood taken for specific serology. Full investigation with imaging and flexible cystoscopy is still advisable in adults over the age of 40. Younger patients, particularly teenagers with positive serology, could be spared the significant discomfort of cystoscopy unless the haematuria and symptoms fail to resolve with treatment.

Acknowledgements

The authors would like to acknowledge the Scottish Parasite Diagnostic Laboratory, Stobhill Hospital, Glasgow for the serology screening.

References


