Screening of Tanzanian women of childbearing age for urinary schistosomiasis: validity of urine reagent strip readings and self-reported symptoms

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The screening of women of childbearing age for haematuria, leukocyturia and proteinuria to detect urinary schistosomiasis can be confounded by several factors such as menstruation, pregnancy and genitourinary infections. We therefore undertook a study in an area endemic for *Schistosoma haematobium* in the United Republic of Tanzania to carry out the following: assess the sensitivity, specificity and predictive values — in women of childbearing age — of indirect indicators of urinary schistosomiasis, as measured by urine reagent strip readings; assess the predictive values of self-reported symptoms; and finally to estimate the morbidity attributable to *S. haematobium*.

A total of 303 women (128 and 175, respectively, living in high- and low-risk sites) participated in the study. Haematuria was more frequent among women excreting *S. haematobium* eggs than among those who did not (65% versus 32%). The predictive potential of all indirect disease markers was poor in the highly endemic site, while in the sites with low endemicity the negative predictive values were high. Among infected women, 54% of haematuria could be attributed to *S. haematobium*, but for patients with more than 10 eggs/10 ml the attributable fraction rose to 70%. Symptoms of ''bloody urine'' and ''pain while urinating'' were recalled significantly more often by women living in the highly endemic site. On a population level, one-third of the self-reported cases with bloody urine could be attributed to urinary schistosomiasis.

Screening of women of childbearing age for urinary schistosomiasis using urine reagent strips can be biased in two directions. The prevalence of *S. haematobium* will be overestimated if other causes of haematuria, such as reproductive tract infections, are highly endemic. On the other hand, women with light or very light infections will be missed and will not be treated. This is of concern because genital schistosomiasis, a possible risk factor for the transmission of HIV, occurs among women even with light infections.

Keywords: *Schistosoma haematobium*, diagnosis; *Schistosoma haematobium*, urine; menstruation, urine; reagent strips; interviews; sensitivity and specificity; predictive value of tests.

Voir page 547 le résumé en français. En la página 547 figura un resumen en español.

Introduction

Haematuria (HU), leukocyturia (LU) and proteinuria (PU) are widely accepted as indirect markers for urinary schistosomiasis in screening procedures (*1*). In individual patients, urine reagent strip readings for HU, LU and PU correlate with the number of eggs excreted (*2–4*). However, the presence of blood in urine due to menstruation or genitourinary infections are factors that can confound urine reagent strip results (*5*). Moreover, in older age groups the frequency of HU does not follow the *Schistosoma haematobium* prevalence curve (*6*). It is therefore unclear what proportion of symptomatic cases are actually due to *S. haematobium* infection.

The main symptoms of schistosomiasis are usually known and easily recognized by members of the afflicted communities (*7*). Structured interviews with schoolchildren and their teachers, following a simple protocol, have been used to identify schools at low risk and exclude them from further screening (*7, 8*). The diagnostic potential of this approach has not been assessed in women of childbearing age.

The present study was intended to achieve the following: assess the sensitivity, specificity and predictive values of HU, LU and PU as measured by urine reagent strips against a gold standard of egg excretion in urine; assess the predictive value of self-reported symptoms of urinary schistosomiasis; and estimate the morbidity (haematuria and self-reported symptoms) attributable to *S. haematobium* in women of childbearing age.

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Materials and methods

The study was carried out in November and December 1995 at the following sites in the Kilimanjaro Region of the United Republic of Tanzania: the Tanzania Plantation Company (TPC) in Moshi Rural District; Chekerini in Moshi Rural District; and Kileo in Mwanga District. As random sampling was not possible due to limited resources, we carried out a non-probability sampling procedure. Both village leaders and the TPC administration informed the villagers about the purpose of the study.

(i) TPC is a sugar cane plantation founded in 1936, which was taken over by the Tanzanian government in the 1980s. It is situated on the banks of the Were river and involves about 12 000 workers and dependants who live in eleven camps. Mollusciciding of irrigation canals harbouring infected intermediate hosts is carried out on a regular basis by the company. From among some 800 women who worked in TPC's irrigation department, 109 whose main activity was maintenance of the irrigation canals were invited by the company administration to participate in the study.

(ii) Chekerini is a village on the banks of the Rau river, where rice cultivation was introduced shortly after it was founded in the 1970s. The inhabitants are mainly farmers. A total of 66 women who attended the local dispensary in the same week were enrolled to participate in the study.

(iii) In Kileo a traditional irrigation scheme has enabled the villagers to grow rice for many years. A total of 128 women volunteered to participate in the study.

The demographic characteristics of the study sites and study population are given in Table 1. Urine samples, obtained between 11:00 and 13:00 on three consecutive days, were examined for *S. haematobium* eggs using the trypan-blue filtration technique (*1*). Before urinating, the women drank approximately 300 ml of soda-water to minimize the day-to-day variation of egg excretion (*10, 11*). The urine samples were thoroughly mixed, 50 ml was filtered, and the number of eggs counted and expressed as the number per 10 ml. A woman was regarded as being infected with *S. haematobium* if eggs were detected in at least one urine sample. The presence of eggs in urine was used as the "gold standard" for the evaluation of the diagnostic value of HU, PU and LU and self-reported symptoms.

The urine was assessed for HU, PU and LU using urine reagent strips (Nephur-Test + Leuco, Boehringer, Mannheim, Germany). For the statistical analysis of the sensitivity, specificity, predictive values and attributable fraction for each study participant, one sample of urine out of three was selected randomly.

All study participants were interviewed in Kiswahili using a standardized and pre-tested questionnaire covering sociodemographic, behavioural and health-related questions. Women were categorized as menstruating if menstruation had started less than 8 days before the interview. The sensitivity and specificity of the self-reported symptoms of bloody urine (perceived macrohaematuria, *kukojoa damu*) and pain while urinating (perceived dysuria, *maumivu wakati wa kukojoa*) were calculated. The predictive values were calculated for each marker.

Table 1. **Demographic characteristics of the study population**

	Low-risk sites		High-risk site
	TPC	Chekerini	Kileo
Population[a]	12 000[b]	2 800[c]	3 772[d,e]
Approximate no. of eligible women	800[f]	670[a]	771[e]
No. of women recruited (% of eligible population, approx.)	109 (14%)[g]	66 (10%)[g]	128 (17%)[g]
Age (years)			
Median	30.5	31	31
Range	15–50	16–45	15–50
Prevalence of schistosomiasis Eggs/10 ml urine	5/109 (5%, 4.0)[h]	2/66 (3%, 136)[h]	68/128 (53%, 2.9)[h]
Measured and perceived morbidity indicators:			
Haematuria (%)	35	39	55
Bloody urine (%)	22	5	36
Pain while urinating (%)	55	47	69

[a] See ref. *22*.

[b] Study participants belong to 30 different ethnic groups.

[c] Study participants belong mainly to two ethnic groups (Wapare and Wachagga).

[d] Study participants belong mainly to one ethnic group (Wapare).

[e] According to a household census carried out by G.P. in September 1996.

[f] No. of women working in the irrigation department of TPC (approx.).

[g] Percentage of approximate number of eligible population.

[h] %, median.

Statistical analysis

Sensitivity, specificity, and predictive values were determined, with 95% confidence intervals (CI). Differences between proportions were compared using the χ^2 test. Age-adjusted prevalence ratios (PR, numerically equivalent to the relative risk), population attributable fractions (AFP, the proportion of a morbidity indicator attributable to *S. haematobium* infection in the population), and exposed attributable fractions (AFI, proportion of a morbidity indicator attributable to *S. haematobium* infection rather than other etiologies in infected individuals) were determined as described by Guyatt et al. (*12*) and Booth (*13*). Attributable fractions were calculated using the Attributable Risk Calculator (*14*).

Ethical considerations

The study was planned in collaboration with the Regional Medical Officer of Kilimanjaro Region and

the District Medical Officers of Moshi and Mwanga Districts. The Research and Ethical Clearance Committee at the Kilimanjaro Christian Medical Centre gave ethical clearance. Women with schistosomiasis were treated free of charge with 40 mg/kg praziquantel given in divided doses. Women without egg excretion in the urine, but with suspected bladder or gynaecological infections, were referred to the Kilimanjaro Christian Medical Centre.

Results

Parasitological findings

In Chekerini, TPC, and Kileo 3%, 5%, and 53% of the study participants, respectively, were infected with *S. haematobium*. In Kileo, a typical age–prevalence curve was observed, the 15–19-year age group showing the highest proportion of infection (73%); however, the intensity of infection was low (median, 2.9 eggs per 10 ml urine; range, 0.1–754). Since the age–prevalence curves in TPC and Chekerini were almost identical, these two sites were combined for the data analysis and considered as "low-risk sites" (n = 175), while Kileo was the "high-risk site" (n = 128) (Table 1).

Urine reagent strip examination

Results of urine examination. Haematuria (HU) was more frequent in women excreting *S. haematobium* eggs than in those without egg excretion (65% versus 32%; P <0.001; odds ratio (OR) = 3.87 (95% CI = 2.14; 7.02)). The difference was not significant for PU (12% versus 9%; P >0.05; OR = 1.45 (95% CI = 0.63; 3.33)) and LU (57% versus 54%; P>0.05; OR = 1.11 (95% CI = 0.66; 1.88)). HU was present in all the women excreting >10 eggs per 10 ml urine (17/17) and in 54% (31/57) of the women excreting <10 eggs per 10 ml urine. In 35% of the infected women, no HU was detected using urine reagent strips. The frequencies of disease markers in women with/without egg excretion in urine are given in Table 2.

Sensitivity, specificity and predictive values. Sensitivity, specificity and predictive values for the different disease markers are given in Table 3. Both the negative and positive predictive values of all disease markers performed poorly in the high-risk site. In the low-risk sites, the negative predictive values were >96% for all markers.

Haematuria in relation to age and the menstrual cycle. The proportions of HU, by age group and risk site, in relation to egg excretion are shown in Fig. 1. Although the frequency of urinary schistosomiasis decreased from 73% in the 15–19-year age group to 43% in women >39 years, the frequencies of HU showed a tendency to increase in the older age groups. In the low-risk sites, HU was present in 18–38% of the women not excreting eggs in urine, the frequencies being highest in the older age groups.

At the time of the urine examination, some 35% of the study participants said that they were menstruating and 30% of the women reported amenorrhoea for various reasons (lactation, pregnancy, prepuberty, use of family planning methods). HU was present in the intermenstrual phase in 20–75% of women infected with *S. haematobium* and in 10–17% of women without egg excretion. Among the menstruating women, HU was found in 50–65% of infected women and in 33–53% of women without egg excretion (Fig. 3).

History of bloody urine and pain while urinating

Bloody urine and pain while urinating were mentioned as symptoms of urinary schistosomiasis by, respectively, 69% and 42% of women living in the high-risk site, while only 36% and 6% of the women in the low-risk sites believed that these symptoms were related to urinary schistosomiasis. Significantly more women living in the high-risk site, compared with women from the low-risk sites, reported having the symptoms of bloody urine (35% versus 6%, P <0.001, OR = 8.2 (95% CI = 3.9; 16.6)) and "pain while urinating" (70% versus 42%, P <0.001, OR = 3.04 (95% CI = 1.88; 4.94)). The proportions of women with self-reported bloody urine, by age group, egg excretion and risk site, are given in Fig. 2. Women claiming to have bloody urine showed significantly more HU than women not reporting this symptom (P <0.001; sensitivity 64% (95% CI = 49.5; 75.9), specificity 64% (95% CI = 57.4; 69.5)).

HU was present in 33% of the women with urinary schistosomiasis who mentioned bloody urine, while 34% showed HU without reporting this symptom; 27% of the infected women neither reported symptoms nor showed HU. The sensitivity, specificity and predictive values of the two self-reported symptoms are given in Table 4. The predictive values of the symptom "bloody urine" were comparable with the assessment of HU, although the sensitivity was lower.

Attributable fractions

The age-adjusted prevalence ratios for HU, "bloody urine", and "pain while urinating" (dysuria) were

Table 2. **Proportions of disease markers in women with and without excretion of *Schistosoma haematobium* eggs living in a high- or low-risk site**

	No. of women with urinary schistosomiasis		No. of women without urinary schistosomiasis	
	Low risk (n = 7)	High risk (n = 67)	Low risk (n = 168)	High risk (n = 61)
Haematuria	4 (57)[a]	44 (66)	48 (29)	26 (43)
Proteinuria	1 (14)	8 (12)	14 (8)	6 (10)
Leukocyturia	4 (57)	38 (58)	92 (54)	32 (53)

[a] Figures in parentheses are percentages.

Table 3. **Sensitivity, specificity and predictive values of disease markers (n = 303)**

Indicator	Sensitivity	Specificity	Positive predictive value		Negative predictive value	
			High-risk site[a]	Low-risk site[b]	High-risk site[a]	Low-risk site[b]
Haematuria	64.9 (52.8–75.4)[c]	67.7 (61.2–73.6)	54.7 (40.6–68.2)	7.5 (2.4–19.1)	57.5 (41.0–72.6)	97.4 (92.0–99.3)
Leukocyturia	56.8 (44.8–68.1)	45.9 (39.3–52.5)	51.9 (38.0–65.5)	6.5 (2.7–14.2)	52.5 (41.1–63.7)	98.7 (91.9–99.9)
Proteinuria	12.2 (6.1–22.3)	91.3 (86.6–94.5)	61.5 (32.3–84.9)	14.3 (2.5–43.8)	53.8 (37.4–69.6)	96.8 (92.2–98.9)

[a] Low-risk site: n = 175.

[b] High-risk site: n = 128.

[c] Figures in parentheses are 95% confidence limits.

significantly higher than 1 (Table 5). Among infected individuals, 70% of the those with bloody urine could be explained by schistosomiasis haematobium, whereas only 54% of the HU assessed by the urine reagent strip reading was attributable to the infection. On the population level, one-third of the cases of bloody urine were attributable to infection with *S. haematobium*. The age-adjusted prevalence ratio increased with the intensity of infection. The increase was greater for HU than for bloody urine.

Discussion

HU, PU and LU are indirect disease markers that are commonly used to identify infected individuals or communities at risk of *S. haematobium* infection. However, in the screening of communities, reagent strip-detected HU and PU might be less reliable predictors for an *S. haematobium* infection than previously reported, although stratification by sex and age tend to increase the validity (*15*). It has been observed that, in women, the levels of HU do not follow the age-related prevalence curve of *S. haematobium*. In contrast, HU tends to increase with age in women both with and without urinary schistosomiasis (*6*).

Screening of women of childbearing age using indirect disease markers may be biased in several ways. First, the presence of morbidity indicators in the urine could be due to other etiologies such as menstruation, genitourinary infection and/or the sequelae of genital mutilation. Accordingly, the specificity (test negative if disease is not present) will drop and the positive predictive value (disease present if test is positive) will be low if, for example, reproductive tract infections are highly prevalent. Thus, women will be classified falsely as positive and may receive treatment when they do not need it. In our study the already low specificity of HU dropped from 76% in non-menstruating women to 61% in menstruating women.

The frequency of HU in women living in the low-risk sites was >20% for all age groups. This finding is corroborated by those of a recent study from Ghana, which reported that girls showed a much higher probability of presenting with haematuria in the absence of egg detection than boys. Furthermore, haematuria was observed in 14% of adolescent girls (*S. haematobium* prevalence, <1%), while no case of HU was discovered in boys of the same age group (*16*).

Fig. 1. **Comparison of the frequency of haematuria in women with or without egg excretion and in women living in the high- or low-risk site, versus age group**

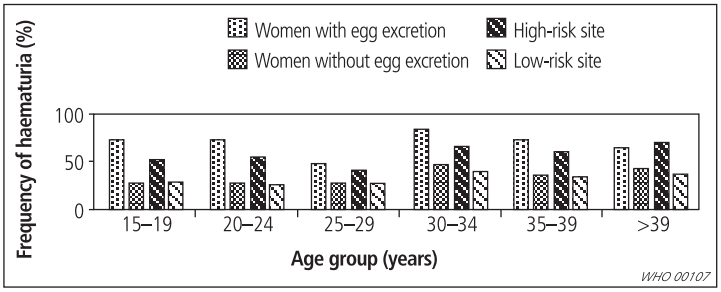

Fig. 2. **Comparison of the self-reported symptom "bloody urine" in women with or without egg excretion and in women living in the high- or low-risk site, versus age group**

Fig. 3. **Haematuria versus days of menstrual cycle**

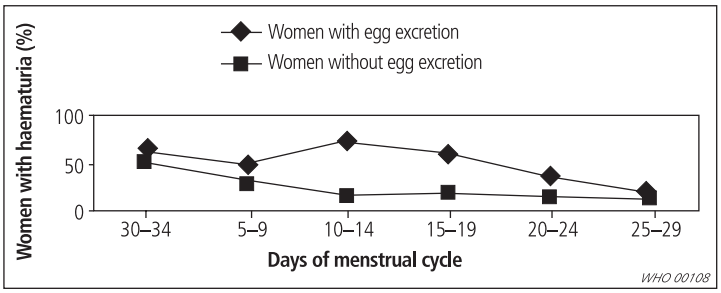

Table 4. **Sensitivity, specificity and predictive values of self-reported symptoms (n = 303)**

Reported symptom(s)	Sensitivity	Specificity	Positive predictive value		Negative predictive value	
			High-risk site	Low-risk site	High-risk site	Low-risk site
Bloody urine	34.9 (25.1–46.0)[a]	85.2 (80.0–89.3)	52.7 (38.9–66.1)	9.1 (0.5–42.9)	50.0 (39.6–60.1)	96.3 (91.7–98.5)
Pain while urinating	68.6 (57.6–77.9)	50.0 (43.6–56.4)	52.3 (42.5–62.0)	4.1 (1.1–12.1)	52.1 (37.4–66.5)	96.0 (89.5–98.7)

[a] Figures in parentheses are 95% confidence limits.

Table 5. **Age-weighted prevalence ratios (PR) and attributable fraction estimates for the population (AFP) and for the infected population (AFI)**

Symptom/sign	PRω[a]	AFPω[a]	AFIω[a]
Haematuria	2.09 (1.543–2.855)[b]	0.22 (0.134–0.357)	0.54 (0.400–0.732)
⩾ 10 eggs/10 ml	2.76 (1.918–3.969)	0.12 (0.069–0.193)	0.70 (0.570–0.855)
Bloody urine	2.76 (1.843–4.126)	0.33 (0.211–0.513)	0.70 (0.575–0.856)
⩾ 10 eggs/10 ml	3.12 (1.890–5.135)	0.16 (0.086–0.312)	0.77 (0.647–0.919)
Dysuria	1.42 (1.117–1.807)	0.09 (0.047–0.205)	0.37 (0.221–0.618)
⩾ 10 eggs/10 ml	1.48 (1.071–2.004)	0.04 (0.013–0.129)	0.38 (0.190–0.761)

[a] Weighted for age.

[b] Figures in parentheses are 95% confidence limits.

In our study of infected women, only 54% of HU detected by urine reagent strip readings could be explained by a *S. haematobium* infection and, on a population level, only 22% of the HU was attributable to *S. haematobium*. Similarly, the specificity of LU was only 49%. These results indicate that other disease conditions are likely to be responsible for the presence of HU and LU, especially for the older age groups. Although we do not have data about the occurrence of sexually transmitted diseases (STDs), the health workers in all study sites expressed their concern that STDs are a major problem in their community. In Kahe, a village neighbouring Chekerini, STDs were present in 47% of women, but only in 14% of men (*17*).

Secondly, in persons with light infections HU is a frequent, but not a constant indicator of urinary schistosomiasis (*18*). As a consequence, the negative predictive value of HU will be low (disease not present if test is negative). This has a serious impact on control activities, because those in need will be considered false negatives and remain without treatment. In our study, HU was detected in all women with eggs counts >10 eggs per 10 ml urine, but when egg excretion was below this threshold, nearly half of the women were without HU. Accordingly, the negative predictive value of HU in the high-risk site was as low as 58%.

The use of interviews to elicit a history of HU is an appealing approach to identify infected individuals because of its low cost. However, when this method is used it is important to consider the cultural and socioeconomic context of the womens' lives, which may have an influence on taking a medical history. For example, women may be reluctant to talk about bloody urine and/or menstruation if menstruation is seen to be an illness (*19*), and the screening results will therefore be biased. The difference in the concordance of reported bloody urine and the assessment of HU by urine reagent strip readings between infected and non-infected women in the present study may indicate that women experiencing HU as a consequence of *S. haematobium* infection are more aware about the symptom than women without urinary schistosomiasis. Lwambo et al. (*9*) concluded that medical history alone is not suitable for identifying infected individuals because the sensitivity can be as low as 40% for a history of bloody urine among adults. In this study the specificity, sensitivity and predictive values of the self-reported symptom compared well with the reagent strip-measured HU although, on a population level, only one third of the cases of "bloody urine" were attributable to *S. haematobium*.

In conclusion, when screening women of childbearing age using urine reagent strips or interview techniques, biases may occur in two directions: overestimation of the true prevalence of urinary schistosomiasis due to false positive HU, and underestimation in women with scanty egg output who nevertheless may have genital schistosomiasis (*20*). The latter is of relevance since genital lesions are thought to be a risk factor for STD organisms, especially HIV (*21*). ■

Acknowledgements

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Résumé

Dépistage de la schistosomiase urinaire chez les Tanzaniennes en âge de procréer : validité des résultats donnés par les bandelettes réactives et des symptômes décrits par les malades

Chez les femmes en âge de procréer, la recherche d'une hématurie, d'une leucocyturie et d'une protéinurie pour détecter une schistosomiase urinaire peut être gênée par plusieurs facteurs : cycle menstruel, grossesse et infections génito-urinaires. Nous rapportons ici les résultats d'une étude effectuée dans une région d'endémie de *Schistosoma haematobium* située en République-Unie de Tanzanie. Cette étude a permis d'évaluer la sensibilité, la spécificité et la valeur prédictive – chez les femmes en âge de procréer – d'indicateurs indirects de la schistosomiase urinaire mesurés au moyen de bandelettes réactives ainsi que la valeur prédictive des symptômes tels qu'ils sont décrits par les patientes, et de procéder par ailleurs à une estimation de la prévalence de la morbidité associée à *S. haematobium.*

Au total, 303 femmes (dont 128 vivant dans des endroits à haut risque et 175 dans des endroits à faible risque) ont participé à cette étude. Une hématurie a été plus fréquemment retrouvée chez les femmes excrétant des œufs de *S. haematobium* que chez les autres (65 % contre 32 %). La différence observée n'était pas significative pour la protéinurie (12 % contre 9 %) et la leucocyturie (57 % contre 54 %). Le potentiel prédictif de tous les marqueurs indirects de la maladie a été médiocre dans les endroits de forte endémie alors que, dans ceux de faible endémie, leur valeur prédictive négative a été élevée. Pour l'ensemble des classes d'âge, la fréquence de l'hématurie a été supérieure à 20 % chez les femmes n'excrétant pas d'œufs ainsi que chez les femmes vivant dans des zones de faible endémie. Chez les femmes infestées, 54 % des hématuries ont pu être attribuées à *S. haematobium* ; en revanche, chez les patientes dont l'urine contenait plus de 10 œufs pour 10 ml, la fraction attribuable passait à 70 %. Les femmes vivant dans des zones de forte endémie ont signalé plus fréquemment avoir eu du « sang dans les urines » et des « douleurs pendant qu'elles urinaient » (35 % contre 6 % et 70 % contre 42 %, respectivement). Au niveau de la population, un tiers des cas dans lesquels les patientes signalaient spontanément avoir eu du « sang dans les urines » pouvaient être attribués à la schistosomiase urinaire.

Le dépistage de la schistosomiase urinaire chez les femmes en âge de procréer au moyen de bandelettes réactives peut être faussé de deux façons. La prévalence de *S. haematobium* va être surestimée si d'autres causes d'hématurie telles que les infections des voies génitales sont fortement endémiques. D'autre part, on va ainsi passer à côté des femmes ayant des infestations légères ou très légères et qui ne seront donc pas traitées. C'est une question préoccupante du fait que la schistosomiase génitale, qui est un facteur de risque possible de la transmission du virus de l'immunodéficience humaine (VIH), est une pathologie féminine qui se déclare même chez des femmes présentant des infestations légères.

Resumen

Cribado de la esquistosomiasis urinaria entre las mujeres en edad fecunda de Tanzanía: validez de las lecturas de la tira reactiva para orina y síntomas autonotificados

El cribado de la esquistosomiasis urinaria entre las mujeres en edad fecunda mediante el análisis de la hematuria, la leucocituria y la proteinuria puede verse confundido por varios factores tales como el ciclo menstrual, el embarazo y las infecciones genitourinarias. Presentamos los resultados de un estudio emprendido en una zona de endemicidad de *Schistosoma haematobium* de la República Unida de Tanzanía a fin de evaluar la sensibilidad, la especificidad y el valor predictivo – en las mujeres en edad fecunda – de los indicadores indirectos de esquistosomiasis urinaria proporcionados por la lectura de tiras reactivas para orina; evaluar el valor predictivo de los síntomas autonotificados; y, por último, calcular la prevalencia de la morbilidad por *S. haematobium.*

Participaron en el estudio 303 mujeres (128 y 175 de, respectivamente, zonas de alto y de bajo riesgo). La hematuria fue más frecuente en las mujeres que excretaban huevos de *S. haematobium* que en las que no lo hacían (65% frente a 32%). La diferencia no fue significativa en lo tocante a la proteinuria (12% frente a 9%) y la leucocituria (57% frente a 54%). El potencial predictivo de todos los marcadores indirectos de la enfermedad fue escaso en la zona altamente endémica, mientras que en los lugares de endemicidad baja los valores predictivos negativos fueron altos. Para todos los grupos de edad, la frecuencia de hematuria fue superior al 20% en las mujeres que no excretaban huevos, así como en las que vivían en un lugar de endemicidad baja. En las mujeres infectadas, el 54% de los casos de

hematuria pudieron atribuirse a *S. haematobium*; sin embargo, en las pacientes con más de 10 huevos por 10 ml la fracción atribuible se elevó a un 70%. La mención de la presencia de «orina sanguinolenta» y de «dolor durante la micción» fue significativamente más frecuente entre las mujeres que vivían en la zona de alta endemicidad (35% frente a 6%, y 70% frente a 42%, respectivamente). A nivel poblacional, un tercio de los casos autonotificados con «orina sanguinolenta» pudieron atribuirse a esquistosomiasis urinaria.

El cribado de la esquistosomiasis urinaria entre las mujeres en edad fecunda mediante las tiras reactivas para orina puede estar sesgado en dos sentidos: se tenderá a sobreestimar la prevalencia de *S. haematobium* en las situaciones de alta endemicidad de otras causas de hematuria, como por ejemplo las infecciones del aparato reproductor; y por otro lado, las mujeres con infecciones leves o muy leves pasarán desapercibidas y no serán tratadas. Esto resulta preocupante dado que incluso esas mujeres afectadas por una ligera infección pueden sufrir esquistosomiasis genital, dolencia que constituye un posible factor de riesgo en lo tocante a la transmisión del virus de la inmunodeficiencia humana (VIH).

References

1. **Feldmeier H.** Diagnosis. In: *Human schistosomiasis*. Wallingford, England, CAB International, 1993.
2. **Mott KE et al.** Relation between intensity of *Schistosoma haematobium* infection and clinical haematuria and proteinuria. *Lancet*, 1983, **1**: 1005–1008.
3. **Feldmeier H et al.** Simultaneous use of a sensitive filtration technique and reagent strips in urinary schistosomiasis. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1982, **76**: 416–421.
4. **Mott KE et al.** Evaluation of reagent strips in urine tests for detection of *Schistosoma haematobium* infection: a comparative study in Ghana and Zambia. *Bulletin of the World Health Organization*, 1985, **63**: 125–133.
5. **Feldmeier H et al.** A synoptic inventory of needs for research on women and tropical parasitic diseases. II. Gender-related biases in the diagnosis and morbidity assessment of schistosomiasis in women. *Acta Tropica*, 1993, **55**: 139–169.
6. **Eltoum IA.** Evaluation of eosinophiluria in the diagnosis of schistosomiasis haematobium: a field-based study. *American Journal of Tropical Medicine and Hygiene*, 1992, **46**: 732–736.
7. **Lengeler C et al.** Community-based questionnaires and health statistics as tools for the cost-efficient identification of communities at risk of urinary schistosomiasis. *International Journal of Epidemiology*, 1991, **20**: 796–807.
8. **Lengeler C et al.** Rapid, low-cost, two-step method to screen for urinary schistosomiasis at the district level: the Kilosa experience. *Bulletin of the World Health Organization*, 1991, **69**: 179–189.
9. **Lwambo NJ et al.** Control of *Schistosoma haematobium* morbidity on Pemba Island: validity and efficiency of indirect screening tests. *Bulletin of the World Health Organization*, 1997, **75**: 247–252.
10. **Doehring E et al.** Day-to-day variation and circadian rhythm of egg excretion in urinary schistosomiasis in the Sudan. *Annals of Tropical Medicine and Parasitology*, 1983, **77**: 587–594.
11. **Wilkins HA.** Time of collection of specimens of *Schistosoma haematobium* egg counts. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1984, **78**: 278.
12. **Guyatt H et al.** Assessing the public health importance of *Schistosoma mansoni in different endemic areas: attributable fraction estimates as an approach. American Journal of Tropical Medicine and Hygiene*, 1995, **53**: 660–667.
13. **Booth M.** The application of attributable risk analysis in helminth epidemiology. *Parasitology Today*, 1988, **14**: 497–500.
14. **Booth M.** *The Attributable Risk Calculator*. Basel, Swiss Tropical Institute, 1999.
15. **Hammad TA et al.** Haematuria and proteinuria as predictors of *Schistosoma haematobium* infection. *American Journal of Tropical Medicine and Hygiene*, 1997, **57**: 363–367.
16. **Hall A et al.** Blood in the urine of adolescent girls in an area of Ghana with low prevalence of infection with *Schistosoma haematobium. Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1999, **93**: 411–412.
17. **Klouman E et al.** HIV and reproductive tract infections in a total village population in rural Kilimanjaro, Tanzania: women at increased risk. *Journal of Acquired Immune Deficiency and Human Retrovirology*, 1997, **14**: 163–168.
18. **Feldmeier H et al.** Diagnostic techniques in schistosomiasis control. *Acta Tropica*, 1993, **52**: 205–220.
19. **Mbizvo MT et al.** Reproductive biology knowledge, and behaviour of teenagers in East, Central and Southern Africa: the Zimbabwe case study. *Central African Journal of Medicine*, 1995, **41**: 346–354.
20. **Feldmeier H et al.** Female genital schistosomiasis as a risk factor for the transmission of HIV. *International Journal of Sexually Transmitted Diseases and AIDS*, 1994, **5**: 368–372.
21. **Poggensee G et al.** Schistosomiasis of the lower reproductive tract without egg excretion in urine. *American Journal of Tropical Medicine and Hygiene*, 1998, **59**: 782–783.
22. *Kilimanjaro Regional Statistical abstract*. Dar es Salaam, Bureau of Statistics, 1994.