Validity of Questionnaire to identify Schistosoma haematobium infection

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ABSTRACT

Background : Schistosomiasis is considered as the most important water-based disease, Estimation of S. haematobium infection have recognized in Egypt since ancient times, hematuria known as AAA disease. One of the symptoms of urinary schistosomiasis is visible blood in urine, since this is normally well recognized by children, the assessment of urinary schistosomiasis can be undertaken rapidly and accurately by using a simple questionnaire. This study was done to test the validity self reported blood in urine by questionnaire compared to parasitological methods. Subjects and methods: Across-sectional study was carried. To overall total sample was 1000 patients of different ages, data about history of recent symptoms of schistosomiasis as haematuria and dysuria were collected. In addition, urine microscopic examination was done for detection of S. haematobium eggs by sedimentation centrifugation and nuclepore filtration techniques. Results: The results showed that haematuria by questionnaire had a sensitivity of 54.4% and specificity of 90.8%. When dysuria was considered, sensitivity increased to 75.95% but specificity decreased to 51.2%. When both self reported haematuria and dysuria were considered, sensitivity was 68.3% and specificity 85%, in between the previous results. PPVs ranged between 11.8% and 33.6% whereas NPVs ranged between 95.9% and 96.1%. As for diagnostic efficiency, it was best for haematuria (87.9%).

Conclusion: questionnaire has a moderate sensitivity, a simple questionnaire asking "Did you have blood in urine during the last month?" and "Did you suffer form schistosomaisis during the last months?" is a validated tool that allows for a decision to be taken, questionnaire was shown to have a very high negative predictive value 96%, so that it is safe to use it to identify communities with a low prevalence, so that they can be excluded from the first phases of a control programme, but microscopic examination is more good and not expensive for diagnosis of urinary schistosomiasis infection.

Keywords: Schistosoma haematobium, questionnaire, self reported, validity, Schistosoma eggs, urinary schistosomiasis.
1. Introduction

Schistosomiasis is considered as the most important water-based disease (1). Many species of schistosomes can infect human, but the most important from the medical point of view are; *S.mansoni*, *S.japonicum* and *S.haematobium* (2). Estimation of *S.haematobium* infection have recognized in Egypt since ancient times, hematuria known as AAA disease, was mentioned in the Ebris the papyri, remedies for hematuria were recorded in papyri (3,4). Egypt started to fight against the schistosome disease from 1915 , after the discover of the schistosome life cycle, using snail control and chemotherapy (5). Due to these control projects the prevalence of *S.mansoni* decreased from 32% in 1935 to less than 0.2% in 2016, and the prevalence of *S.haematobium* from 48% in 1935 to less than 0.2% in 2016, but in 300 villages the prevalence still more than 3% , so the Ministry of Health and Population in Egypt has started of a campaign to reach the final elimination of schistosomiasis by 2020 (6).

Urinary schistosomiasis infection depend on water contact activities with some risk factors as gender, age, residence, education and occupation so the control program should be done upon to health education on these risk factors with snail control and chemotherapy (7). In areas where data on schistosomiasis are completely absent, the parasitological survey might not be sufficient to evaluate correctly the parasitological situation. In order to better estimate the prevalence of schistosomiasis, given its focal distribution and its linkage to water resources, it will be necessary to associate the parasitological survey with the Rapid Assessment Method (RAM) that is based on questionnaires (8). One of the symptoms of urinary schistosomiasis is visible blood in urine, since this is normally well recognized by children, the assessment of urinary schistosomiasis can be undertaken rapidly and accurately by using a simple questionnaire distributed to all schools in a delimited administrative or geographical area, the method has proved effective for ranking schools according to the level of transmission of urinary schistosomiasis (WHO1995) (9). The school rank obtained with RAM will allow for a better interpretation of the parasitological results, since only high (or low) prevalence schools could be selected by chance (10). The number of children presenting visible blood in urine must be registered because this is an indicator of heavy infection (11). If a person show visible haematuria, in an area endemic for *S.haematobium*, there is no need for further diagnostic investigation of that person (10).

The questionnaire is a rapid mean of identifying heavily infected schools that should be treated first in urinary schistosomiasis control. It should be sent to all schools in the area concerned, which can be done at a relatively low cost, the questionnaire is short and simple and asks the children whether they have seen blood in their urine at any time during the past month (or a shorter period) (9). In a school where the prevalence of infection is 40 %, half of the infected children would not report schistosomiasis, whereas in a school where the prevalence was 80 %, only a quarter of infections would not have been reported. This observation has important practical relevance for the application of mass treatment when the prevalence of infection exceeds 50 %. If the prevalence of self reported schistosomiasis underestimates the actual prevalence of infection by 20 %, then mass treatment may be given in schools where the prevalence of self reported schistosomiasis is >30 % (12). Prevalence of reported schistosomiasis in schools of >30 % is equivalent to a prevalence of infection of > 50 % and that mass treatment would be warranted (WHO 1995). However, responses may be affected by the age and sex, by the interviewer, and by an awareness of the aims of the programme and the expectation of free treatment. The present study used both questionnaire and microscopic examination of
urine samples to detect of *S.haematobium* eggs for 1000 patient samples to evaluate the validity of questionnaire compared with microscopic examination for diagnosis of *S.haematobium* infection.

**Research objective:**
To evaluate the validity of questionnaire compared with microscopic examination for diagnosis of *S.haematobium* infection.

2. Material and methods

2.1. Study population and ethical consideration

This study included 1000 patients attending Ministry of health laboratory centers, in El-Fayoum Governorate, this study subjects were randomly selected irrespective of the age-group and both sex were included. All the studied population were informed about the purpose of samples collection and their consents were obtained. Patients were free to refuse sample collection.

2.2. Study design

This research is a cross-sectional study designed to evaluate questionnaire of self reported blood in urine for determine urinary schistosomiasis in the study population. This study was targeting customers who came for laboratories of health centers for urine analysis.

2.3. Collection and processing of urine samples

Clean specimen bottles were labeled with the needed information and issued to the participating individuals whose informed consent was sought earlier, each patient was given a wide mouth screw-capped container into which to void urine. This was carried out between 10.00 am and 2.00 pm when ova count of *S.haematobium* is expected to be at its peak. In this study, urinary schistosomiasis was defined as the presence of ova of *S.haematobium* in the urine.

2.4. Urine microscopy

Urine examination was carried out in the laboratory of health centers and by the researcher. Urine samples were examined for the presence of *S.haematobium* eggs as in sedimentation method of Cheesbrough (2006). Each urine sample was mixed thoroughly with a glass rod and two samples were taken each 10 ml urine, one sample for sedimentation centrifugation and other 10 ml urine sample for Nuclepore membrane filtration technique. The first 10 ml transferred into centrifuge tube and centrifuged at 2000 rpm for 5 minutes at room temperature. The supernatant was then discarded and sediment transferred to a microscope glass slide and covered with a cover slip. A drop of Lugol’s Iodine was added onto the cover slip prior to examination. Examination of the entire sediment was carried out using x10 objective of a compound light microscope.

The second 10 ml urine sample were examined using the Nuclepore membrane filtration technique for *S.haematobium* eggs detection as in method of Cheesbrough (2009).

2.5. Questionnaire:

For individuals attending health laboratories the following was done:

Completing a predesigned interview questionnaire that covered the following:

1-Sociodemographic data: age, sex, occupation, residence etc.

2-Exposure to canal water whether, occupational, recreational or domestic exposure.

3-Health problems in the previous week for example burning micturition, urinating blood, malaise, *Schistosoma* infection and menstruation in females.

4-History of hematuria or dysuria
2.6. Statistical analysis

Results collected, coded, tabulated and analyzed through computer facilities using statistical methods *S. haematobium* infection was defined as any number of eggs greater than zero found in 10 ml of urine, was performed to compared with self reported haematuria by simple questionnaire for Diagnosis of *Schistosoma haematobium* Infection.

3. Results

In this study we considered using the sum of Nuclepore membrane as filtration technique and Centrifugation sedimentation technique results as a gold standard to compare them with Questionnaire of self reported Haematuria and Dysuria\(^{(16)}\).

Table (1): shows diagnostic performance of self reported haematuria, dysuria and both as diagnostic methods for *Schistosoma haematobium*

infection compared to microscopic examination techniques as the gold standard.

The results showed that haematuria by questionnaire had a sensitivity of 54.4% and specificity of 90.8%. When dysuria was considered, sensitivity increased to 75.95% but specificity decreased to 51.2%. When both self reported haematuria and dysuria were considered, sensitivity was 68.3% and specificity 85%, in between the previous results. PPVs ranged between 11.8% and 33.6% whereas NPVs ranged between 95.9% and 96.1%. As for diagnostic efficiency, it was best for haematuria (87.9%) followed by both haematuria and dysuria 83.36% and least for dysuria (53.1%). The area under the curve (AUC) was sufficient for haematuria and dysuria( 0.68 and 0.6 respectively) and was good for both(0.72).

Table (1): Diagnostic performance of self reported haematuria, dysuria and both as diagnostic methods for *schistosoma haematobium* compared to microscopic examination techniques as the gold standard.

<table>
<thead>
<tr>
<th>Test</th>
<th>Microscopic techniques</th>
<th>Total No.</th>
<th>Sensitivity %</th>
<th>Specificity %</th>
<th>PPV %</th>
<th>NPV %</th>
<th>PLR %</th>
<th>NLR %</th>
<th>Diagnostic Efficiency %</th>
<th>AUC</th>
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<td></td>
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<td>Positive No.</td>
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<td>83.36</td>
<td>0.72</td>
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PPV, Positive predictive value; NPP, Negative predictive value; PLR, Likelihood ratio for positive results; NLR, Likelihood ratio for negative results; AUC, Area under the curve.
4. Discussion

For *S. haematobium* infection, the presence of micro-or macro-haematuria has enabled the development and validation of a range of indirect diagnostic tests useful for epidemiological mapping of prevalence, such as dipstick methods which detect micro- and macro-haematuria. Simple interview methods to ascertain a history of haematuria have also been shown to be useful. For example, the WHO-supported red urine study and others have established the utility of a simple oral questionnaire for history of haematuria, to estimate the prevalence of infection among school-age children (17,18). When urgent intervention is required to prevent death and liver on bladder damage, often in an environment of civil unrest or man-made or natural disaster, any extra labour and costs needed are problematic. Although no new alternative, simple, fast screening method has been produce, scientific efforts have validated the usefulness of the questionnaire and the reagent strip as simple tools to estimate *Schistosoma haematobium* infection (19).

Therefore a simple questionnaire asking "Did you have blood in urine during the last month?" and "Did you suffer form schistosomaisis during the last months?" is a validated tool that allows for a decision to be taken. The decision to treat all school-age children when 30% of them reported gross haematouria, indicating that 50% have detectable eggs in urine. (Guyatt et al., 1999) (17).

Lower predictive values are observed for the entire population, especially for women of childbearing age due to confounding conditions such as menstruation, pregnancy and genitourinary infections (Utzerger et al., 1998) (20). This aspect must be taken into consideration when planning the complementary strategy of the deworming programme which is based on community action and treatment of groups at high risk of infection. A matter of concern is that the efficiency of the questionnaire and strips test decreases as the prevalence and intensity of infection decrease (19). The "indirect interview" approach using questionnaires, is a method for diagnosis urinary schistosomaisis at community level. It is based on the hypothesis that if communities are ranked according to the percentage of positive answers to the questions "Did you have blood in your urine?" or "Did you have schistosomaisis?" the rank order will be the same as that obtained by ranking them according to the actual prevalence of schistosomaisis, the questionnaire approach first had to be validated to check that this hypothesis is true, by comparing the results for the new approach with those obtained with standard tests (8).

This study showed that self reported schistosomaisis for the presence of blood in urine (macrohaematuria) has a sensitivity of 54.4%, specificity of 90.8%, positive predictive value 33.6% and negative predictive value 95.87%, while sensitivity of dysuria increased to 76% but its specificity decreased to 51.2%, when both self reported haematuria and dysuria sensitivity was 68.3% and specificity 85% in between the previous results, PPVs ranged between 11.8% and 33.6%, where as NPVs ranged between 95.9% and 96.1%, the diagnostic efficiency it was best for haematuria 87.9%, followed by both haematuria and dysuria 83.4% and lower for dysuria 53.1%. The area under the curve (AUC) was sufficient for haematuria and dysuria (0.68 and 0.6 respectively), and was good for both (0.72).

The questionnaire method for determining communities at high risk for urinary schistosomaisis was validated in some African countries, Cameron, Congo, Ethiopia, Malawi, Tanzania, Zambia and Zimbabwe (21,22). The prevalence of urinary schistosomaisis obtained using the questionnaire survey was compared with the prevalence obtained using urine filtration and/or testing for haematuria with chemical reagent strips. In all but one country (Ethiopia) the method was found to work well for "community
diagnosis ”. It was shown to have a very high negative predictive value, so that it is safe to use it to identify communities with a low prevalence, so that they can be excluded from the first phases of a control programme and resources concentrated elsewhere. A few communities with only moderate or low prevalences may not be excluded, because the questionnaires do not have 100% accuracy, but including a few communities which do not really need intervention is less dangerous than missing some that do (21,22).

Ansel J, et al., (1997) studied the reliability of self-reported blood in urine and schistosomiasis as indicators of Schistosoma haematobium infection in Tanzania, they found that the prevalence of reported schistosomiasis showed a strong correlation with prevalence assessed by the microscopy of urine. The sensitivity was ranged from 50% to 75% according to heaviness of infection and the specificity was ranged from 66.4% to 96.4% (12).

Lwambo et al., (1997) 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 (23).

Guyatt H et al., (1999), reported that pain on urination and blood in urine showed strong specificity but very poor sensitivity compared to microscopic egg counts, it must be remembered that these reported symptoms can be caused by other urinary tract infection (17).

Pogggeness G, et al., (2000) studied validity of self reported symptoms for screening of Tanzanian women of child bearing age for urinary schistosomiasis. They found that blood in urine has a sensitivity of 34.9%, specificity of 85.2, positive predictive value in low risk site was 9.1%, positive prediction value in high risk site was 52.7%, negative predictive value in low-risk site way 96.3% and negative predictive value in high-risk site was 50% (24).

MD et al French., (2007). Recorded that these questionnaire tests showed considerable inter-year variability, it seems that they are not reliable general indicators that track the dynamics of morbidity (25).

Fen Yang et al, (2015). Study for validity of questionnaire showed that; diagnostic odds ratio (DOR) was obtained from Schistosoma haematobium (67.68, 95 % confidence interval (CI)=31.48 to145.54), sensitivity 96%, specificity 86%, AUC was 0.96 (26).

Howeida H. Abusalih, et al., (2016). Recorded that Percentage of hematuria in the study population by questionnaire hematuria against presence of schistosoma eggs in urine revealed sensitivity, specificity, positive and negative predictive values as 55.6%, 80%, 43% and 86.9% respectively (27).

Conflicts of interest
There are no conflicts of interest.

Financial support and sponsorship
This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

References:


5. Youssef MM. Current situation and research needs for schistosomiasis control in Egypt (2005), Geneva, WHO Tor/ SWG/ 01, 2005.


