Relationship between *Schistosoma Haematobium* Infection and Urinary Tract Infection among Children in South Eastern, Nigeria.

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Background: *Reports of studies on the relationship between Schistosoma haematobium and Urinary Tract Infection from different regions are conflicting. Hence, the need to determine the situation in each endemic area.*
Objective: *To determine if S. haematobium infection is associated with Urinary Tract Infection (UTI) among children in an endemic area of Cross River State, Nigeria.*
Subjects and Methods: *Mid-stream urine specimen was collected under strict aseptic procedures into wide-mouthed screw-capped sterile plastic containers. All the specimens were kept in a cooler at approximately 4°C for 5-10hr before delivery to the laboratory. Urine microscopy was carried out by gram staining and urine was cultured using blood agar and Mac Conkey agar plates. Collection of urine specimens for schistosoma ova was done between 10.00am and 2.00pm when ova count of S. haematobium is expected to be at its peak.*
Results: *Prevalence of urinary schistosomiasis was 51.0%. One hundred and seventy five (77.4%) of those infected had mild intensity of infection (<49ova/ 10ml). Significant bacteriuria was found in 2(0.9%) of the 226 children with urinary schistosomiasis and in 4(1.8%) of the 217 children without urinary schistosomiasis RR(95%CI) = 0.48 (0.089-2.59) P > 0.68.*
Conclusion: *This study has found the prevalence rate of urinary Schistosomiasis in this community to be 51% and no significant difference in the prevalence of UTI among children with urinary schistosomiasis and those without. However, considering the high prevalence of urinary schistosomiasis seen in this study, urgent control measures should be instituted to address this public health problem.*

Key words: urinary schistsomiasis, children, urinary tract infection.

Urinary tract infection (UTI) is a major health problem among children. [1,2] It is caused mainly by colonic bacteria following ascent through the urethra from the perineum, especially in infancy. However, blood borne bacteria may contribute significantly during the first few months of life [3,4].

The presence of UTI in a child may be an isolated disease. It may also be suggestive of an underlying genito-urinary tract abnormality including congenital malformations of the urinary tract and urinary schistosomiasis[4].

In urinary schistosomiasis, damage is seen mostly in the bladder and lower ureter. It starts as a hyperaemic reaction, followed by nodule and granuloma formation in the bladder and ureter. These lead to hydronephrosis, calcification and contraction of the bladder[5]. These changes can make the urinary tract more susceptible to bacterial infection[4]. Therefore UTI and schistosomiasis may co-exist in the same patient.

Previous studies in Egypt, [6] Nigeria [7] and elsewhere[8] have shown an increased incidence of UTI in patients voiding schistosoma ova in urine. However, this

association has not been confirmed by other workers. [9-10] It would appear therefore that the relationship between UTI and urinary schistosomiasis is not clear as it varies from one locale to the other.

UTI has been considered an important risk factor for the development of renal insufficiency and/or end stage renal disease[3,4]. Schistosomiasis with it attendant lesions may also lead to irreversible obstructive uropathy. The superimposition of UTI on schistosomiasis may therefore hasten renal damage and renal failure. [11] This is of clinical and public health importance.

The present study was undertaken to determine the relationship between UTI and urinary schistosomiasis among children in Adim, south-eastern Nigeria. This will help in making appropriate recommendations for the management and prevention of renal damage from schistosomiasis in this region.

Subjects and Methods

Children attending the only primary school in Adim, a village in Biase local government area of Cross River State, constituted the subjects of the study. The village is located in the rain forest region of south-eastern Nigeria, 110km to the north of the Atlantic Ocean. The community uses one big stream for domestic needs, washing and recreation such as swimming. Sewage disposal is mainly by "communal open toilets." An earlier study of *S. haematobium* infection indicated a prevalence rate of 43.5 % in this community.[12] Allowing for a 5% margin of sampling error, and 95% confidence limit, sample size was determined by the equation:[13]

$$n = \frac{Pq}{(E/1.96)^2}$$

where n = minimum sample size
p = maximum expected prevalence rate (%)
q = 100 –p
E = margin of sampling error tolerated(%)
1.96 = Z value with 95% confidence limit.

Therefore, $n = \frac{43.5 \times (100-43.5)}{(5/1.96)^2} = \frac{2457.75}{6.508} = 378$

The study was carried out in September 2003. The subjects were recruited by randomly selecting three streams in each class. There were four to seven streams in each class. From each stream, subjects aged 5-15years were selected randomly by use of a table of random numbers. Inclusion criteria were residence in the community for at least 6 months; no history of intake of anti-schistosoma drugs in the preceding three months and antibiotics in the preceding two weeks; no clinically obvious genito urinary lesion or trauma and no menstrual bleeding for at least five days prior to the study for the older girls. Before commencement of the study, approval was obtained from the school headmaster and teachers and also from the Ethics/Research committee of the University of Calabar Teaching Hospital. The controls were children who were recruited for the study, but who were not voiding schistosoma ova in urine.

By use of a pre-tested questionnaire, symptoms related to the genito-urinary system (including suprapubic pain, strangury, urgency, frequency, dysuria and enuresis) was obtained from all the children. The younger children gave information with the help of their teachers. Mid-stream urine (urine collected from the stream of urine immediately after the first part of the stream is allowed to pass) was collected under strict aseptic procedures into wide-mouthed screw capped sterile plastic containers with the assistance of the teachers/researchers. In females, the urine was taken in the squatting position. The mid-stream urine was collected from the stream projected forward in the squatting position. In males, care was taken to prevent the glans from contaminating the specimen container as urine was being collected from the stream. All the specimens were kept at approximately 4°C (in a cooler with ice packs) for 5-10hours after collection before delivery to the laboratory. [1, 14]

Preparation and examination of Gram-stained smear were carried out on all urine specimens. Using a disposable sterile pipette (one for each urine specimen), a drop of well mixed uncentrifuged urine was placed on a slide. The drop was allowed to dry without spreading, heated to fix and then gram stained. The slide was examined under oil immersion for presence or absence of bacteria, polymorphonuclear leucocytes and squamous epithelial cells. Presence of one or more bacteria per oil immersion field (usually observed when there are 10^5 or more bacteria per ml present in the specimen), and/or one or more leucocyte per oil immersion field was suggestive of UTI.[14] Each urine culture was done by immersing a sterile loop vertically in the undiluted specimen of urine and this was discharged onto blood agar and Mac Conkey agar plates. The plates were then incubated at 35°C - 37°C overnight and then examined the following day for growth. Identification procedures were done using well separated similarly appearing colonies.[14] In this study, counts of more than or equal to 10^5 per ml were regarded as positive and diagnostic of UTI. [1,14]

Collection of urine specimens for schistosoma ova was done between 10.00am and 2.00pm when ova count of *schistosoma haematobium* is expected to be at its peak. [15,16] This was done after the subjects ran once to and fro the school field. Ova count was done using Nytrel (polyamide) Millipore filter as described by Mott. [17] Each urine sample was mixed by drawing it in and out of a disposable 10mls plastic syringe with a 5cm extension of a straight plastic tubing mounted on the adaptor. Ten milliliters of the urine was then withdrawn and the plastic extension removed. The urine was then injected through a 12mm diameter swine filter support containing 13mm Nytrel Ti 20 HD filter with a mesh size of 20 micron. Once the urine was completely expelled from the syringe, the syringe was removed, filled with air and injected into the filter holder. The procedure was repeated twice to remove excess urine and to force the ova to adhere to the surface of the filter. The filter support was then opened and the filter

removed with forceps and placed face upwards on a glass slide. A drop of saline was added to prevent drying. A drop of Lugol's iodine solution was placed on the filter to stain the ova. The filter was examined under a light microscope (10xmagnification) and the number of eggs on the entire filter was counted with the aid of a hand counter and expressed as number of eggs per 10ml of urine. Urinary schistosomiasis in this study was defined as presence of ova of *S. haematobium* in the urine. The intensity of infection by ova count was graded as light (1-49 ova per 10ml), moderate (50-100 ova per 10ml), Heavy (>100 ova per 10ml) [16]

The data was analysed using EPI info 2002 version. Proportions were compared between groups of discrete variables using relative risk, confidence interval, Fisher exact test, and X^2 test with Yates correction as appropriate. Regression analysis was used to determine relationship between *S. haematobium* infection and Urinary Tract Infection.

Results

Socio-demographic Characteristics

Four hundred and forty three (443) children were examined. Of this, 235 (53.0%) were males and 208(47.0%) females. Their ages ranged between 5 and 15 years. Table i shows the trend in prevalence of urinary schistosomiasis with age among males and females. Overall, 226(51.0%) of the 443 were infected. Out of the 235 males, 121(51.5%) were infected while 105(50.5%) of the 208 females were also infected. There was no statistically significant difference in prevalence rate between males and females except in the 12-15 years age bracket when more females were affected (X^2=3.85 p<0.05).

Intensity of Infection

Table ii shows the intensity of infection by age and sex. One hundred and seventy five (77.4%) of the 226 infected children had mild infection, 31(13.7%) moderate and 20(8.9%) severe infection. There was no statistically significant difference in the intensity of infection between males and females in any of the age groups RR (95%CI) =1.32(1.02-1.71). The mean ova count of infected children was 20 ova/10ml of urine.

Prevalence of Urinary Tract Infection (UTI)

Of the 443 pupils, 6 (1.4%) had significant bacteriuria. Of the 6 pupils with significant bacteriuria, 4 were females and 2 were males, giving a male to female ratio 1:2. Of the 226 children with urinary schistosomiasis, 2 (0.9%), both females, had significant bacteriuria while among the 217 without schistosomiasis, 1.8% (two males and two females) had significant bacteriuria. The RR(95%CI) of bacterium in children with schistosomiasis was 0.65(0.20-2.02), X^2=0.213 p>0.324.

Table iii shows the prevalence of bacteriuria according to sex and presence or absence of urinary schistosomiasis. There was no statistically significant difference in the prevalence of bacteriuria between the parasite positive and the parasite negative groups in either sex.

Table iv shows the organisms isolated from children with significant bacteriuria in ova positive and ova negative groups. *Escherichia coli* was isolated in one of 226 ova positive and two of 217 ova negative children (p>0.62). *Klebsiella* species was isolated in one of 226 of ova positive and in two of 217 of ova negative children (p>0.62).

Table i: Prevalence of infection in relation to age and sex

Age (yr)	Male subjects No Exa	Male subjects infection N(%)	Female subjects No Exa	Female subjects Infected N(%)	Both Sexes subjects Total Exa	Both Sexes subjects infected N(%)	RR(95% CI)	X^2	P
5-8	89	34(38.2)	61	18(29.5)	150	52(34.7)	0.79(0.51-1.22)	0.85	0.18
9-11	89	55(61.8)	103	54(52.4)	192	109(56.8)	0.80(0.58-1.12)	1.72	0.19
12-15	57	32(56.1)	44	33(75.0)	101	65(64.4)	1.66(0.96-2.87)	3.07	0.04
Total	**235**	**121(51.5)**	**208**	**105(50.5)**	**443**	**226(51.0)**	**0.98(0.81-1.18)**	**0.04**	**0.83**

Key: no exa = number examined.

Table ii: Intensity of *S. haematobium* infection in relation to age and sex.

Intensity of infection	Age / sex 5-8yr Male N(%)	5-8yr Female N(%)	9-11yr Male N(%)	9-11yr Female N(%)	12-15yr Male N(%)	12-15yr Female N(%)	Total
Mild	27(15.4)	12(6.9)	42(24.0)	42(24.0)	22(12.6)	30(17.1)	175(100)
Moderate	4(12.9)	4(12.9)	9(29.0)	8(25.8)	5(16.1)	1(3.2)	31(100)
Severe	3(15.0)	2(10.0)	4(20.0)	4(20.0)	5(25.0)	2(10.0)	20(100)
Total	**34(15.0)**	**18(8.0)**	**55(24.3)**	**54(23.9)**	**32(14.2)**	**33(14.6)**	**226(100)**

Table iii: Prevalence of bacteriuria in relation to *S.haematobium* infection according to sex.

Urinary schistosomaisis	Male subjects No	n (%) with UTI	Female No subjects	n (%) with UTI	RR (95%CI)*	X^2	P
Present	121	0 (0.0)	105	2 (1.9)	1.02 (0.99-1.05)	0.64	0.219
Absent	114	2 (1.8)	103	2 (1.9)	1.00 (0.97-1.04)	0.16	1.000
Total	**235**	**2 (0.9)**	**208**	**4 (1.9)**	**0.98 (0.14-6.83)**	**0.63**	**0.68**

Table iv: The bacteria isolates from urine cultures of those having bacteriuria with or without *S. haematobium* infection.

Urinary Schistosomiasis	Organism *klebseiella*	*Esch. Coli*	Total
Present	1	1	2
Absent	2	2	4
Total	3	3	6

Discussion

The prevalence rate of 51.0% for *S. haematotium* infection among primary school children in Adim, Cross River State is high. It is comparable to the rate of 43.5% recorded from a previous study done in the same community[12] as well as 44.1% [16] from Ugep, a nearby community. However, lower rates of 24% [15], 25.5%, [18] 17% [19] and 27.2% [20] were recorded among primary school children in Western, Eastern, Northern and North-Eastern Nigeria respectively. This high prevalence of infection may be attributed to the sanitary habits of the community.[11] The communal "open latrines" located on the hills ensure that rain washes the wastes into the bodies of water located at the foot of the hills. This ensures that the cycle of infection continues. Also the community uses one big stream, which runs across the breath of the community for domestic needs, washing and recreation such as swimming. This enhances regular contact with the water, thus maintaining infection[11].

The age bracket, 9-14years was most affected by urinary schistosomiasis. This agrees with the finding of several other studies. [15,21] Within this age range, it would appear that contact with water is at its highest level due to domestic and recreation purposes.The result of the present study did not show any statistically significant difference in the prevalence rate and intensity of infections between females and males except at 12-15years when females were more affected. The higher prevalence of infection in girls at this age may be due to the fact that in this village girls do most of the domestic chores, including the fetching of water for domestic use. This observation, however, contrasts with the report of a higher prevalence and intensity of infection among males in Western Nigeria[15].

The intensity of infection was generally light as 77.4% had mild infection. This study was conducted in the rainy season. The results are thus in keeping with the pattern of infection in other areas of Nigeria where the intensity of infecton is mild during the rainy season(May-September) and high during the dry season.[22]

The 1.4% prevalence of significant bacteriuria in association with urinary schistosomiasis found in this study is similar to the reported prevalence of 1.37% in a schistosoma endemic area [10] and 0.4% [23], 1.6% [24] and 2.1%[2] in non-endemic areas of Zaria, Port-Harcourt and Enugu respectively. However these rates are lower than 6.6%, 5.1%and 5.6% reported from endemic areas of Gambia [8], Egypt [6] and from Western-Nigeria.[25] This higher prevalence reported from these areas may be due to the high intensity of infection in these studies.

The reported association between UTI and *S. haematobium* infection was not seen in this study. Other studies from Nigeria and elsewhere[9,10] similarly did not also report any association between UTI and schistosomiasis. The later reports[9,10] and the present study may however, have methodological bias in using controls within the same study population who may actually have infection but are not voiding ova in urine at the point of examination or who may have aftermath of the lesions of infection. Nonetheless, the reported prevalence rates of 0.4%,[23] 1.6%,[24] and 2.1% [2] in non-endemic areas of Nigeria are similar to the present study. This may indicate that there is no association between schistosomiasis and UTI even when endemic is compared with non-endemic areas in Nigeria. This is not entirely surprising, as the infection may not have lasted long enough in this children to cause structural changes in the urinary tract that would predispose to UTI. It may also be that the association between UTI and schistosomiasis is only found in heavy burden of disease, that is, when the intensity of urinary schistosomiasis in such endemic areas is very high[8]. The bacteria isolated from the patients with UTI included *Escherichia coli* and *Klebsiella species*. This is similar to the pattern of pathogens isolated in similar studies[6-7] as well as from patients with uncomplicated UTI.[1,2,23,24]

It is therefore concluded that the prevalence of *Schistosoma haematobium* infection in south-eastern Nigeria is high. However, the intensity is generally low. Also, among children in this endemic area, urinary schistosomiasis does not increase the risk of developing UTI. To reduce the magnitude of this public health problem, good water source should be provided in every community especially those endemic for urinary schistosomiasis. Wells and bore-holes should be sunk at strategic places

in the communities to avoid use of the streams and rivers and therefore reduce contact with the schistosomes. Furthermore, the use of Ventilatory Improved Latrines should be introduced into the communities and the "open latrines" discouraged. This is will go a long way in improving the sanitary habits of the people.

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