URINARY TRACT PATHOLOGY IN *SCHISTOSOMA HAEMATOBIUM* INFECTED RURAL NIGERIANS

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Abstract. Parasitological investigation assessing the ova of *Schistosoma haematobium* in the urine of 138 volunteers in Ihieve-Ogben, Edo State, Nigeria revealed 43 positive results (31.2%). Children had a higher prevalence of urinary schistosomiasis 30 (41.1%) than their adult counterparts 13 (20.0%) and this difference was statistically significant (t = 8.89, p>0.01). More volunteers had light intensity of infection 27 (19.6%) than heavy infection 16 (11.6%) and this difference was statistically significant (χ^2 = 22.90, p>0.05). Ultrasonographic investigations carried out on these 43 *S. haematobium* infected volunteers revealed ten pathological conditions, including abnormal wall thickness 24 (55.8%), abnormal shape 30 (69.8%), irregular bladder wall 12 (27.9%), masses 10 (23.3%), pseudopolyps 2 (4.7%), echogenic particles 30 (69.8%), residual volume 12 (27.9%), calcifications 24 (55.8%), hydroureter 10 (23.3%) and hydronephrosis 8 (18.6%) when compared to control subjects which lacked bladder and kidney abnormalities. These pathological conditions were slightly more common in the volunteers with heavy infection than those with light infection, but this difference was not statistically significant (t = -2.19, p<0.02). More pathological conditions were found in children than in adults; this finding was statistically significant (t = 3.23, p>0.03). Hydronephrosis and hydroureter were not found in the volunteers with light intensity of infection.

INTRODUCTION

Urinary schistosomiasis is a chronic parasitic infection of the circulatory system caused by *S. haematobium* which affects the bladder and subsequently the urinary tract system of man. The effect of *S. haematobium* infection is due to deposition of eggs in the bladder and ureter which elicits chronic granulomatous injury. This granulomatous inflammation causes nodules, polypoid lesions and ulcerations of the lumen of the ureter and bladder, which results clinically in urinary frequency, dysuria and terminal hematuria. The disease may progress and terminate in renal failure or carcinoma of the bladder. The clinical picture and disease outcomes in persons infected with *S. haematobium* vary dramatically, ranging from mild symptoms to severe damage of the urinary tract including the kidney and bladder (Brouwer *et al,* 2003b).

In some endemic areas of Africa where facilities for diagnosis are limited, estimation of these pathological process is performed by the clinical picture, using hematuria as the method. The use of non-invasive techniques, such as ultrasound, in investigating morbidity due to *S. haematobium* has been documented (Degremont *et al*, 1985; Leutscher *et al*, 2000; Brouwer *et al,* 2003b). Degremont *et al* (1985) documented renal congestion and irregularity of the bladder wall. Renal pathology has been reported by Brouwer *et al* (2003b) among rural population of Zimbabwe.

In this locality the use of ultrasonography

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to assess the morbidity of urinary schistosomasis is lacking despite the fact that ultrasound examination readily demonstrates the structural morbidities caused by *S. haematobium.* The existing data are mainly epidemiological (Osisanya *et al*, 1990; Akonai *et al,* 1992; Anosike *et al*, 1992; Arinola, 1995; Useh and Ejezie, 1996; Nmorsi *et al*, 2001). In the present investigation, we report the prevalence of urinary schistosomasis in Ihieve-Ogben, Edo State, Nigeria. We also report the pathology found on ultrasonic examination of the urinary tract.

MATERIALS AND METHODS

This investigation was carried out in Ihieve-Ogben in Owan East local government area of Edo State and FaithDome Medical Center in Ekpoma, Esan West local government area of Edo State, Nigeria. These study areas are located at latitude 6ºN and longitude 6ºE.

Ihieve-Ogben is located within the guinea savanna region of the state. The villagers are mainly farmers and hunters, while a few of them, mostly women, are traders.The village has a stream which the inhabitants use as their source of water and recreational activities. There are about 1,000 inhabitants in this community.

Ekpoma is an urban town with a university, and a population structure of civil servants, university wokers and traders. It has a population of about 300,000 inhabitants. It is located within a rainforest belt and the town lacks a stream. It depends on pipe-borne water as well as ponds and wells.

This investigation commenced during a community mobilization campaign at Ihieve-Ogben. This involved educating them regarding the significance of the study as well as seeking their consent. Ethical permission was obtained from the State Ministry of Health, Benin City, Nigeria and FaithDome Medical Center, Ekpoma, Edo State. Pre designed questionnaires containing data regarding sex, age, occupation, and gross hematuria were obtained from the volunteers. Mid stream urine samples were collected from 138 individuals as well as 20 control subjects between 11:00 and 13:00 GMT after slight physical exercise. The specimen was kept in a wide-mouthed screw capped 50 (ml) size container. These bottles containing the urine samples were immediately transported to our parasitological laboratory for examination for the ova of *S. haematobium.* The ova were quantified and classified as light infection ≤50 ova/10 ml and heavy infection >50 ova/10 ml according to WHO standards (WHO, 1983).

The 43 volunteers who excreted *S. haematobium* ova in their urine were recruited for the next phase of the study. The volunteers were investigated by transabdominal ultrasonography at the Radiology Unit of FaithDome Medical Center. The examinations were done using a Fukuda Denshi UF 4000 (Japan) ultrasound machine with a 3.5 MH_2 frequency curulinear real time probe. The volunteers were asked to drink 0.1 - 1.5 liters of water, depending on their age, and examined in the supine position for bladder and kidney abnormalities 30 minutes to one hour later. The kidneys were also scanned from the back in the prone position. The patients were then asked to empty their bladder and examined for post-void residual. The abnormalities were classified according to WHO standards (WHO, 1996). A pathologically rounded (distorted) bladder was given a score of 1 (compared to the normal rectangular shape of the bladder). If the wall thickness was >5 mm, a score of 1 was given if it was focal and a score of 2 was given if it was multifocal or diffuse. A mass was considered a localized thickening of the bladder wall protruding into the lumen (>10 mm) and was given a score of 2. Multiple masses (n) were given a score of n+2. A pseudopolyp was defined as an outgrowth of the wall, attached by

Table 1
The prevalence and intensity of *Schistosoma haematobium* infection in Ihieve-Ogben, Nigeria by sex and age.

	Population examined		Light infection <50 ova/10 ml		Heavy infection >50 ova/10 ml		Total
	Male	Female	Male no. (%)	Female no. (%)	Male no. (%)	Female no. (%)	Total no. (%)
Children	38	35	10 (26.4)	8 (22.9)	7 (18.4)	5 (14.3)	30 (41.1)
Adults	36	29	6 (16.7)	3 (10.3)	2 (5.6)	2 (6.9)	13 (20.0)
Total	74	64	13 (17.6)	14 (21.9)	9 (12.2)	7 (10.9)	43 (31.2)
Grand total	138		27 (19.6)		16 (11.6)		43 (31.2)

a slender base (narrower than the mass). A single pseudopolyp was given a score of 2. A hydroureter was given a score of 3 when the ureter was dilated and 4 when it was markedly dilated. Hydronephrosis was given a score of 6 when the kidney was moderately dilated. A normal non-pathological state was given a score of 0.

The data obtained in this study were evaluated statistically using Microsoft Excel.

RESULTS

Table 1 shows the prevalence and intensity of *S. haematobium* infection among the 138 volunteers examined in Ihieve – Ogben, Nigeria according to their sexes and ages. Of the 138 volunteers, 43(31.2%) of them excreted *S. haematobium* ova in their urine and had terminal hematuria. Children were infected more frequently than adults (30 cases *vs* 13 or 41.1% *vs* 20.0%, respectively) and this difference was statistically significant (t = 8.89, p>0.01). Male and female volunteers were infected nearly equally. More volunteers had light infection (n=27, 19.6%) than heavy infection (n=16, 11.6%) and this difference was statistically significant (χ^2 = 22.90, p>0.05).

The urinary tract pathology according to the intensity of *S. haematobium* infection is presented in Table 2. Ten pathological conditions were observed: wall thickness 24 (55.8%), abnormal shape 30 (69.8%), irregular bladder wall 12 (27.9%), masses 10 (27.9%), pseudopolyps 2 (4.7%), significant residual volume 12 (27.9%), echogenic particles 30 (69.8%), calcifications 24 (55.8%), hydroureter 10 (23.3%) and hydronephrosis 8 (18.6%). Amongst the volunteers with light infection the most common pathological conditions, abnormal bladder shape and echogenic particles, were observed in 18 (66.7%). The volunteers with heavy infections and calcified bladders 14 (87.7%) had the most prevalent pathological conditions. The structural urinary tract diseases found in volunteers with heavy infection were more prevalent than in those with light infection, however, this difference was not statistically significant (t = -2.19, p<0.02).

The classifications of urinary tract disease and kidney pathology in the children and adult volunteers are presented in Table 3. Children had more urinary tract diseases than adults. This difference was statistically significant (t = 3.23, p<0.03. Hydronephrosis and hydroureter were absent in the volunteers with light infection. The highest prevalence of abnormal bladder shape with echogenic particles occurred in children 22 (73.3%). Amongst adults, abnormal bladder shape and echogenic particles were most prevalent (61.5%).

DISCUSSION

Data regarding the prevalence of *S.*

Table 2
The urinary tract disease by intensity of *S. haematobium* infection.

S/NO.	Pathology	Classification No.	Light infection No. (%)	Heavy infection No. (%)	Total No. (%)
1.	Urinary bladder pathology		27	16	43
	Wall thickness	1	12 (44.4)	8 (50.0)	24 (55.8)
		2	-	4 (25.0)	
	Shape	1	18 (66.7)	12 (75.0)	30 (69.8)
	Irregularity	1	2 (7.4)	6 (37.5)	12 (27.9)
		2	-	4 (25.0)	
	Masses	2	-	4 (25.0)	10 (23.3)
		n+2, (n=1) = 3	-	6 (37.5)	
	Pseudopolyp	2	-	2 (12.5)	2 (4.7)
	Echogenic particles	-	18 (66.7)	12 (75.0)	30 (69.8)
	Residual urine	1	5 (18.5)	7 (43.8)	12 (27.9)
	Calcification	1	6 (22.2)	14 (87.5)	24 (55.8)
		2	-	4 (25.0)	
2.	Hydroureter	3	-	10 (62.5)	10 (23.3)
3.	Hydronephrosis	6	-	8 (50.0)	8 (18.6)

n = number of masses

Table 3
The classification of urinary tract diseases by age in volunteers infected with *S. haematobium* in Ihieve-Ogben, Nigeria.

S/NO.	Pathology	Classification No.	Children No. (%)	Adults No. (%)	Total No. (%)
1.	Urinary bladder pathology		30	13	43
	Wall thickness	1	16 (53.3)	4 (30.8)	24 (55.8)
		2	3 (10.0)	1 (7.7)	
	Shape	1	22 (73.3)	8 (61.5)	30 (69.8)
	Irregularity	1	6 (20.0)	2 (15.4)	12 (27.9)
		2	2 (6.7)	2 (15.4)	
	Masses	2	4 (13.3)	-	10 (23.3)
		n+2, (n=1) = 3	3 (10.0)	3 (23.1)	
	Pseudopolyp	2	6 (20.0)	-	2 (4.7)
	Echogenic particles	-	22 (73.3)	8 (61.5)	30 (69.8)
	Residual urine	1	7 (23.3)	5 (38.5)	12 (27.9)
	Calcification	1	17 (56.7)	3 (23.1)	24 (55.8)
		2	4 (13.3)	-	
2.	Hydroureter	3	4 (13.3)	6 (46.2)	10 (23.3)
3.	Hydronephrosis	6	3 (10.0)	5 (38.5)	8 (18.6)

n = number of masses

haematobium infection among volunteers indicated that 31.3% excreted ovae in their urine, indicating mesoendemcity of infection. This level of endemicity appears more common than the earlier reports of Nmorsi *et al* (2001), Arinola (1995) and Osisanya *et al* (1990) within the same zoogeographical region. The data in this present study reflect the level of exposure in the locality where there is an absence of pipe-borne water which com-

pels the inhabitants to frequently visit the only stream in the community for their domestic and recreational activities. The high level of water contact in children, as well as acquired immunity in adults, can explain the prepondance of infection in children. This is supported by an earlier study by Nmorsi *et al* (2001).

Children in Ihieve-Ogben and those with heavy infection with *S. haematobium* had more urinary tract pathology. Of the ten different pathological conditions observed among volunteers, abnormal wall thickness, shape, echogenic particles and calcifications constituted the principal pathological conditions of bladder dysfunction and damage in Ihieve-Ogben, Nigeria. The prevalence of urinary tract pathology in Ihieve – Ogbe corresponds to an investigation by Brouwer *et al* (2003a) in rural Zimbabwe where children were reported to have bladder pathology in 50%. Of significance is the preponderance of these conditions with high intensity *S. haematobium* infection. This correlation of irregularity of bladder wall and major renal congestion with the prevalence and intensity of *S. haematobium* along with microhematuria has been documented previously (Degremont *et al,* 1985).

The report of urinary masses and pseudopolyps among these volunteers is of pathological significance despite the low prevalence. This observation is in agreement with previous reports by others (Chen and Mott, 1989; Thomas *et al*, 1990; Mostafa *et al*, 1999). Thomas *et al* (1990) reported that bladder cancer was common in Zimbabwe and postulated it was due to the high prevalence of *S. haematobium* infection in the areas investigated. Mostafa *et al* (1999) and Chen and Mott (1989) documented an association between bladder cancer and schistosomiasis.

We found the hydroureter and hydronrephrosis in both children and adults with high intensity of infection. These findings contradict an earlier investigation by King *et al* (1988) who reported that hydroureter and hydronephrosis were not associated with higher infection intensity among the inhabitants screened in Coast Province, Kenya. However, the assertion by King *et al* (1988) that structural forms of urinary tract disease, such as hydronephrosis, progress during the course of untreated *S. haematobium* infection despite age related reductions in egg burden. This was confirmed by our study where we documented the higher prevalence of hydroneprosis and hydroureter among the adults despite lower intensity of infection.

The bladder and kidney pathology revealed in this investigation can be used as important tools in monitoring the morbidity of *S. haematobium* in Ihieve – Ogben, Nigeria. As the disease progresses without treatment, more serious disorders occur, such as calcified bladder (Haslett *et al*, 2002), urothelial metaplasia and cancer formation (King, 2001) hydronephrosis, ureterolithiasis and renal dysfunction. Since it has been documented that urinary tract pathology, especially hydronephrosis, regresses upon treatment of *S. haematobium* infection (Subramanian *et al*, 1999; Wagatsuma *et al,* 1999) it is imperative to institute chemotherapy.

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