

Renal Data from the Arab World

Ultrasound Findings in Urinary Schistosomiasis Infection in School Children in the Gezira State Central Sudan

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ABSTRACT. To evaluate the ultrasound findings of urinary schistosomiasis in Quran school (Khalwas) children in Gezira State Sudan, we studied all the students from two schools. A total of 103 boys were tested for urinary schistosomiasis using the urine filtration method. *Schistosoma haematobium* (*S. haematobium*) eggs were counted. Ultrasound was performed for all the positive subjects. Seventy-three (71%) subjects were positive for *S. haematobium*. The mean age was 11.3 ± 2.9 years. Sixty-six (90.4%) subjects showed urinary tract abnormalities. The findings revealed the following degrees of wall thickening: 53.0% mild, 18.2% moderate and 21.2% severe. Urinary bladder polyp(s) were noted in 43.3% (single) and 40.9% (multiple) of the subjects, and calcification of the bladder wall was observed in 7.6% subjects. Ureteric dilatation was noted in 38/73 (52.0%), while hydronephrosis was detected in 19/73 (26.3%). The vast majority of urinary tract schistosomiasis lesions were in the urinary bladder. Ultrasound is a useful tool for identifying the morbidity of *S. haematobium* in endemic areas.

Introduction

The incidence of urinary schistosomiasis infection is increasing in endemic areas of Africa as a consequence of irrigation programs and hydroelectric power development.¹ Urinary schistosomiasis is a disease of children and young adults. The adult worms live mainly in the venous plexus of the urinary bladder and

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the morbidity is caused by egg deposition in and around the urinary tract, causing inflammation and lesions. *Schistosoma haematobium*-related pathology is found mainly in the urinary bladder, the ureters and kidneys.² At present, schistosomiasis control programs are targeted at morbidity reduction in the populations. Diagnosis is still based on parasitology and serology, and ultrasound has proven to be an important means to evaluate the extent of the lesions of the urinary tract, such as dilatation of the renal pelvis and bladder wall lesions.^{3,4} Ultrasound can also provide direct information about lesions in the other internal organs.⁵ Despite lacking specificity, proteinuria

and parasite eggs count are the best methods to predict bladder pathology.^{6,7} Several studies have demonstrated that ultrasound is useful in the detection of morbidity induced by schistosomiasis on an individual basis and at the community level.⁸⁻¹⁰ Ultrasound detects serious consequences of *S. haematobium*, and it was concluded that schistosomiasis remained an important public health problem in sub-Saharan Africa.¹¹ Post-treatment monitoring has provided evidence for reversibility of the pathological lesions induced by *S. haematobium*.¹² Ultrasound has already been used in a number of epidemiological studies in areas where *S. haematobium* is endemic and has proven to be feasible and useful.¹³ The aim of this study was to evaluate the ultrasound findings among school children who were positive for *S. haematobium* in Gezira State, Sudan.

Materials and Methods

One hundred and three students in two Quran schools for males (Khalwas) were recruited for this cross-sectional study during 2009–2010. Hilat Rodwan is located in the south west of Wadmedani city, Gezira state Sudan, surrounded by irrigation canals. There is no available clean tap water and open canals are the main source of water supply. All the children had an age range between seven and 20 years. Girls were not included in the study because the schools were only for boys; girls in our culture do not frequently go to the canals like boys and most studies showed that boys were more exposed to the infection with mainly *S. haematobium* than girls (Alamin et al 2009 unpublished). Written informed consent and assent was obtained from each participant. Ethical approval was obtained from the National Cancer Institute Research Ethical Committee (NCIREC). A total of 103 urine specimens were collected between 10:00 am and 2:00 pm, the time of optimum egg passage, and kept cool in an insulated ice box and transferred to the laboratory within 4 h after collection. Microscopy was performed on the product of filtration of 10 mL of urine. The presence of *S. haematobium* egg was consi-

Table 1. Distribution of age range of the study subjects ($N = 73$).

Age range	No. of subjects (%)
7–9	24 (32.9)
10–12	32 (43.8)
13–15	10 (13.7)
16–18	6 (8.2)
19–20	1 (1.4)
Total	73 (100)

dered as positive for *S. haematobium* infection. Ultrasound was used by a qualified radiologist to examine the positive cases, using an ultrasound apparatus (Aloka SSD-500 portable ultrasound with a 3.5-MHz curvilinear probe; Aloka, Tokyo, Japan). The subjects were asked to drink water prior to the scan to fill their urinary bladder. Both the lower urinary tract (bladder) and the upper urinary tract (kidneys and ureters) were evaluated. The following changes were considered as pathological lesions in the lower urinary tract: bladder wall thicker than 5 mm and presence of bladder polyp(s) or wall nodularity. In the upper tract, the left and right ureteric wall thickness and dilatation were recorded. Kidney dilation was recorded as mild, moderate and severe.

Statistical Analysis

Data were expressed as the mean and standard deviation (SD), as appropriate. Comparison and characteristics between the variables were performed using the Chi-square test and Fisher's exact test as appropriate. The Statistical Package for Social Science (SPSS 16.0 for windows) was used in performing all the statistical analysis, and P -value less than 0.05 was considered as significant.

Results

All the study subjects were exposed to the *S. haematobium* infection from 6 months to 12 years. A total of 73/103 (71%) children were positive for *S. haematobium*, with low (less than 100 eggs/10 mL) and high (more than 200 eggs/10 mL) egg counts. All positive subjects were examined by ultrasound. The mean age of all the positive subjects was 11.3 ± 2.9 years,

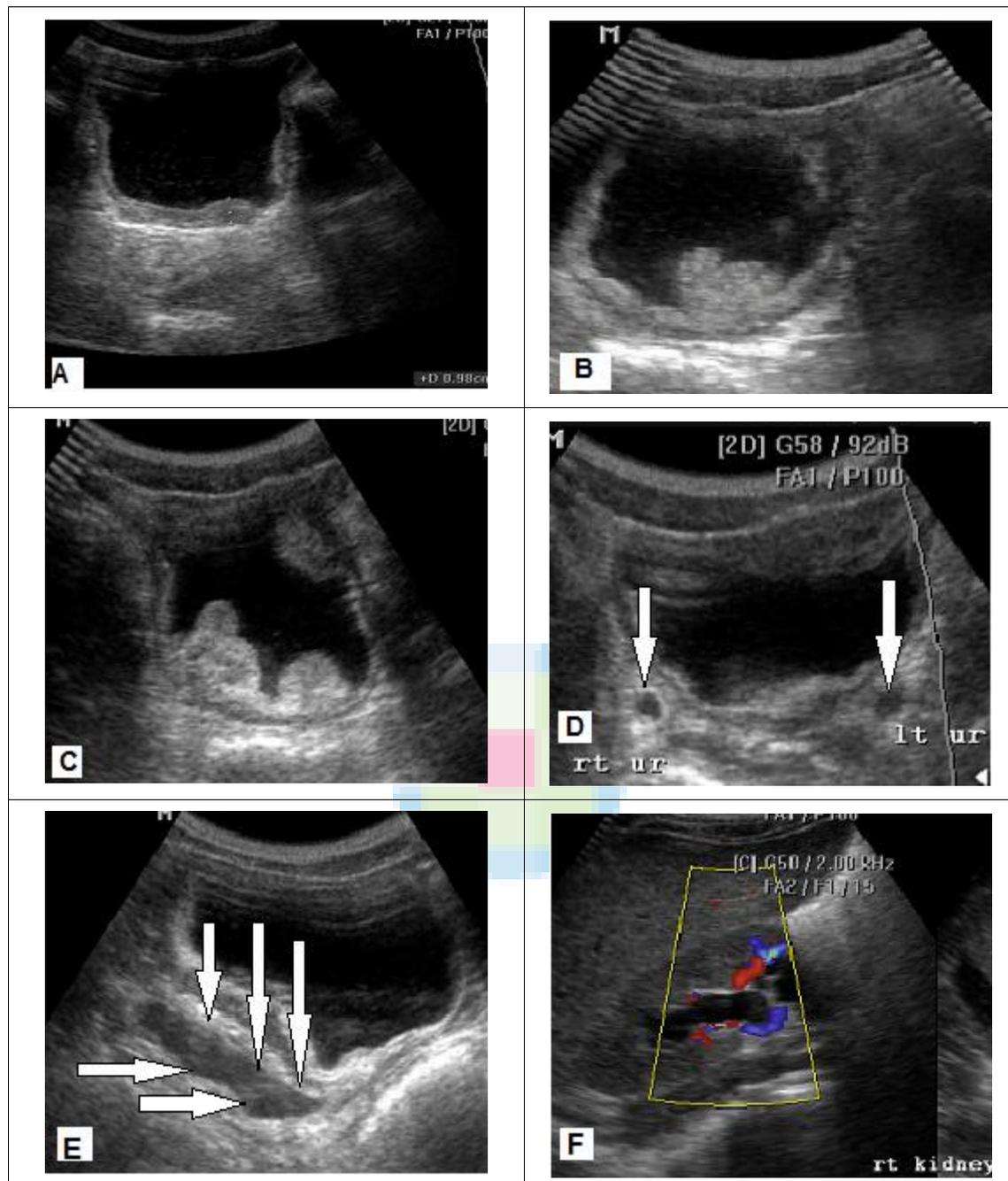


Figure 1. Different ultrasound findings of urinary schistosomiasis, (A) urinary bladder wall thickening measuring 98 mm, (B) solitary urinary bladder polyp, (C) multiple urinary bladder polyps, (D) axial view of urinary bladder showing bilateral ureteric dilatation (arrows), (E) longitudinal view showing ring distal ureteric dilatation and (F) longitudinal view showing mild hydronephrosis.

with a range from 7 to 20 years, as shown in Table 1. Ultrasound of the urinary bladder revealed that 66/73 (90.4%) patients had some degree of wall thickening (Figure 1A), ranging from mild to severe, as follows: 35/66 (53%)

mild, 12/66 (18.2%) moderate and 14/66 (21.2%) severe. There was no significant difference between the different age groups ($P > 0.05$) as shown in Table 2. Twenty-seven out of 66 (40.9%) patients had multiple polyps

Table 2. Distribution of subjects according to the severity of the disease using urinary bladder wall thickening in correlation with age.

Age range	Severity of the disease				Total
	No.	Mild	Moderate	Severe	
7-9	3	14	2	3	22
10-12	3	13	8	7	31
13-15	0	3	2	4	9
16-18	0	4	0	0	4
19-20	0	0	0	0	0
Total	6	34	12	14	66

Table 3. Distribution of study subjects according to the presence or absence of urinary bladder lesion(s) with age.

Age range	N = 66	Thickness	Mass		
		Mean ± SD	No (%)	One polyp (%)	Multiple polyps (%)
7-9	22	9.5 ± 6.4	7 (31.8)	11 (50.0)	04 (18.2)
10-12	31	12.0 ± 6.2	5 (16.1)	11 (35.5)	15 (48.4)
13-15	09	08.8 ± 3.8	3 (33.3)	0	06 (66.7)
16-18	04	07.8 ± 6.7	2 (50.0)	0	02 (50.0)
19-20	00	0	0	0	0
Total	66		17 (25.8)	22 (33.3)	27 (40.9)

Table 4. Distribution of study subjects according to the degree of severity of the disease using ureteric dilatation with age.

Age range	N = 73	Unilateral left		Unilateral right		Bilateral		Total = 38 (%)
		Mild	Moderate	Mild	Moderate	Mild	Moderate	
7-9	24	1	0	2	0	5	0	8 (33.3)
10-12	32	1	0	4	1	11	1	18 (56.2)
13-15	10	1	0	1	0	4	0	6 (60.0)
16-18	6	1	0	1	0	4	0	6 (100)
19-20	0	0	0	0	0	0	0	00

(Figure 1 C) and 22/66 (33.3%) had a single polyp (Figure 1B, Table 3). The ultrasound findings of ureters showed that 38/73 (52%) patients had different degrees of ureteric dilatation, (Figures 1D and 1E). However, no patient had a severe degree of ureteric dilatation, and there were no significant differences between the different age groups (Table 4). The kidneys ultrasound showed that 19/73 (31.2%) patients had different degrees of hydronephrosis; 18 patients had a mild hydronephrosis (Figure 1F) and only one patient showed a moderate degree of hydronephrosis. However, there were no significant differences between the different age groups (Table 5). The result showed that 32/66 (48.5%) patients had bladder and ureter abnormalities, while 16/66 (24.4%) showed bladder, ureter and kid-

ney abnormalities and 3/66 (4.5%) had both bladder and kidney abnormalities. There was an increase in the severity of disease with the increased egg count, but it was not significant (Table 6).

Discussion

In endemic areas in the tropics, ultrasound is highly sensitive for assessment of morbidity related to *S. haematobium* infection, which is associated with typical bladder lesions.¹⁴ Ultrasound with a simple portable machine offers a unique opportunity to investigate morbidity at the community level. Non-invasively, in large field surveys, it has thus become an important tool for clinical and epidemiological research.¹⁵ This study revealed that 71% of the study sub-

Table 5. Distribution of study subjects according to the degree of severity of the disease using hydronephrosis of kidneys in correlation with age.

Age range	N = 73	Unilateral left		Unilateral right		Bilateral		Total 18 (%)
		Mild	Moderate	Mild	Moderate	Mild	Moderate	
7-9	24	1	0	2	0	0	1	3 (12.5)
10-12	32	3	0	3	1	3		10 (31.2)
13-15	10	1	0	1	0	1	0	3 (30.0)
16-18	6	0	0	1	0	1	0	2 (33.3)
19-20	1	0	0	0	0	0	0	0

Table 6. Association between egg count and severity of the disease by US.

Egg count	Severity of the disease				Total (%)
	No.	Mild (%)	Moderate (%)	Severe (%)	
<100	6	18 (48.6)	6 (16.2)	7 (18.9)	37 (100)
101-199	2	07 (46.7)	4 (26.6)	2 (13.3)	15 (100)
>200	4	10 (47.6)	2 (09.5)	5 (23.8)	21 (100)
Total	12	35	12	14	73

jects were positive for *S. haematobium* and 83.6% had ultrasound abnormalities, which is comparable to the results of the study done by Serieye et al who found that echographic abnormalities of the urinary tract were present in 50.5% of the study population.¹⁶ The same results were found in Niger in two villages (64.3% and 58.8% ultrasound abnormalities).¹⁷ This demonstrates that lesions involving the upper urinary tract are also well visualized, but do not constitute a specific finding. Community-based screening for *S. haematobium* in endemic areas has shown a high prevalence of bladder wall thickening, irregularities and polyps, which were usually more frequent and severe in children.¹⁸ In our study, urinary bladder polyps were detected in 80.3%. Similar findings were found in Yemen, Tanzania and Niger.¹⁹⁻²¹ Regarding the upper urinary tract, 52% of our study subjects were found to have ureteric dilatation, which was comparable to other studies.¹⁹ However, Lamothe et al showed that in Niger, the prevalence of hydronephrosis was 36.1% in children.²¹ In Tanzania, kidney pathologies (congestive changes) were found in 36% of the school children.¹⁷ Ultrasound can make a valuable contribution to the monitoring of control programs, and the data collected should enable proper decisions to for morbidity reduction.² The best applications for ultrasound in schistosomiasis

is to include community-based diagnostic studies and post-therapeutic follow-up. In contrast, ultrasound is not suitable for an individual patient attending a health service seeking medical advice. In endemic areas, ultrasound may be useful for an individual diagnosis if more effective methods are unavailable, such as urinalysis for hematuria and egg counts. However, the poor specificity of some images is a major limitation for its use in zones of low prevalence of schistosomiasis.²² We conclude that ultrasound is a useful tool for identify the morbidity of *S. haematobium* in endemic areas, especially for children. Ultrasound can be used for detection of complications and follow-up of therapy.

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