Ultrasonographica ssessment of urinary tract lesions due to Schistosoma haematobium in Niger after four consecutive years of treatment with praziquantel

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Abstract

A comparative study on the extent of urinary tract abnormalities detected by ultrasound was conducted in two villages in an irrigated area of Niger where the pre-treatment prevalences were 64.3% and 58.8% respectively. Fewer bladder lesions (20% of abnormalities) and fewer renal lesions (6% of abnormalities) were observed after four consecutive years of follow-up and treatment with praziquantel in the study village as compared to the control village where 54% bladder abnormalities and 36% renal abnormalities were observed. This study suggests that morbidity due to *Schistosoma haematobium* infection can be reduced by annual treatment over several years in a highly endemic area without other associated interventions.

Introduction

Several studies have shown the usefulness of ultrasonographic examination in detecting renal and bladder lesions resulting from urinary schistosomiasis (Burki et al., 1986; Degrémont et al., 1985; Devidas et al., 1989; Doehring et al., 1985a, 1985b; Heurtier et al., 1986). This simple, rapid, noninvasive diagnostic technique, has no contraindications, is easily accepted by the population and is well suited for large scale surveys in endemic areas.

Praziquantel has shown to be effective in the treatment of urinary schistosomiasis with high cure rate and/or reduction in intensity of infection after single oral dose (Gentilini et al., 1982; Kardaman et al., 1983; Lapierre et al., 1983). Furthermore urinary tract lesions, detected by ultrasound, have been shown to revert to normal within a one year follow-up period after treatment (Devidas et al., 1989).

The present study evaluates the impact of annual treatment with praziquantel during four consecutive years on renal and bladder lesions, in a population where *S. haematobium* is endemic.

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Study Populations

This investigation was undertaken in a group of villages of Liboré district, located around Niamey (Niger), on the left bank of the Niger river, surrounded by irrigated fields, where *S. haematobium* is transmitted by *Bulinus truncatus rohlfsi*.

Initially 2853 inhabitants of Liboré village, including 1641 women and 1212 men had parasitological urine examinations in 1983. Annual selective population chemotherapy was done, before the transmission season (December to April) (Mouchet et al., 1983). All persons had a single urine examination of 10 ml followed by treatment of infected persons with praziquantel at 40 mg/kg in a single dose.

During those four years, a cohort of 392 persons were examined annually and were eligible for retreatment if positive. Among those 392 persons, 342 (= 87%) were examined one year after the last treatment which included a parasitological urine examination and ultrasonography of the urinary tract.

During four consecutive years these 342 persons were examined annually, 51 treated four times, 68 three times, 82 twice, 92 once and 49 none because the examens were negative.

After completion of the treatment, a control village, Sébéri, was selected on the basis of similar demographic and parasitological characteristics to Liboré village and where was available no treatment prior the ultrasound examinations (Heurtier et al., 1986).

Those two populations have similar prevalences of schistosomiasis (56.6% for the treated village, 53.7% for the control village) and arithmetic urinary egg counts average (32.6 for the treated village and 31.5 for the control village) (Table 1), as well as regarding their geographical origin. Both villages were located in comparable irrigated areas.

Methods

A quantitative parasitological urine filtrations technique of a 10 ml random urine sample between 9 am and 2 pm was used (Plouvier et al., 1975), ultrasound examinations were performed with 3.5 Mhz real time sectorial scanners, a Sonel 202 (CGR) in Sébéri, and a ADR 4000 in Liboré. All patients were taken by group of 15 to the Uni-

Table 1 Comparison of the prevalences, prior to intervention, between populations of the treated village (Liboré) and the control village (Sébéri) who have been examined by ultrasound.

Village	Sex	Age average	Age < 15 years			Age > 15 years			Total		
			n	+	(%)	n	+	(%)	n	+	(%)
Treated	Male	19.5	99	61	61.6	63	48	76.2	162	109	67.3
Village	Female	22.3	74	45	60.8	106	66	62.3	180	111	61.7
(Liboré)	Total	20.9	173	106	61.3	169	114	67.5	342	220	64.3
Control	Male	20.6	71	49	69.0	76	44	57.9	147	93	63.3
village	Female	19.8	51	37	72.5	64	24	37.5	115	61	53.0
(Sébéri)	Total	20.2	122	86	70.5	140	68	48.6	262	154	58.8
Statistic tests for age and Prevalence	Male vs. Male	p=0.52		p=0.41			p=0.04			p=0.53	
	Female vs. Female	p=0.11		p=0.24			p=0.003			p=0.18	
	Total vs. Total	p=0.54		p=0.13			p=0.001			p=0.19	

Table 2 Geometric mean egg count and prevalence from 1984 to 1987 in Liboré among 342 persons examined five consecutive times with treatment of all positive cases at each examination

Age	Years	Males		Females	
		Prevalence (%)	GM egg count X+1 eggs per 10 cc	Prevalence (%)	GM egg count X+1 eggs per 10 cc
< 15	1984*	61.6	5.40	60.8	6.36
	1984**	58.6	5.35	55.4	4.61
	1985	47.5	2.71	51.4	3.01
	1986	54.5	3.36	50.0	3.07
	1987	44.4	2.32	36.5	2.14
> 15	1984*	76.2	12.37	62.3	4.60
	1984**	44.4	3.65	40.6	2.34
	1985	34.9	2.36	19.8	1.37
	1986	33.3	1.81	24.5	1.39
	1987	30.2	1.66	15.1	1.42
Total	1984*	67.3	7.45	61.7	5.25
	1984**	53.1	4.61	46.7	3.09
	1985	42.6	2.57	32.8	1.92
	1986	46.3	2.64	35.0	1.92
	1987	38.9	2.03	23.9	1.68

(*): beginning 1984; (**): end 1984.

versity Hospital Center of Niamey. All examinations were done by the same radiologist who was unaware of either the parasitological status of the patients or their residence. Every patient drank 600 ml of water about half an hour before examination.

The same definitions and classifications of bladder and renal pictures were used as during previous studies (Devidas et al., 1989; Heurtier et al., 1986).

Bladder lesions

Three types of bladder lesions unique to *S. haematobium* infection were observed:
- **thickened wall:** the wall was regular but its thickness was between 6 and 10 mm (moderate) or superior to 10 mm (important);
- **irregular wall:** the wall showed a pattern of thick and thin areas (moderate or important);
- **localised bladder wall hypertrophy** (single or multiple): this frequent pattern showed a "large based" polypoid image in the bladder.

In order to classify those lesions according to their importance , we have defined a bladder index with three stages:
- **stage 0:** no bladder lesion;
- **stage 1:** minor lesions, thickness between 6 and 10 mm and/or moderated irregularity, and/or one localised hypertrophy;
- **stage 2:** major lesions, thickness 11 mm and more, and/or very important irregularity, and/or 2 and more localised hypertrophies.

Renal lesions

Observed images are gathered according to the Weill et al. (1985) classification as following:
- **stage 0:** absence of renal lesions;
- **stage I:** mild hydronephrosis, characterized by a slight pyelocalyceal dilatation;
- **stage II:** moderate hydronephrosis, with marked pyelocalyceal dilatation corresponding to conventional urographic pictures;
- **stage III:** major hydronephrosis, with lack of functional parenchyma. This last stage was not observed in this study.

Results

In the study cohort, the prevalence decreased from 64.3% to 31% and geometric mean urinary egg count was reduced from 6.20 to 1.84 eggs/10 ml urine during a four year period (Table 2).

In Liboré, we observed that the majority of the urinary bladders were classified as stage 0 (80%); few stage 1 and especially stage 2 bladder images (18% and 2%) were observed (Table 3).

In the control village, urinary bladders classified as stage 1 and 2 were more frequently observed than stage 0 (stages 1 and 2, 54%; stage 0, 46%).

The rate of bladder abnormalities (defined by three criteria: localised hypertrophies, thickening and regularity) was significantly higher in the control village where only 46% of people were not affected as compared to the study village where lesions were much less numerous and severe (Table 3).

Bladder calcifications were not recorded, since their detection done by ultrasonography is unreliable (Devidas et al., 1989).

Table 3 Comparison of the ultrasonographic bladder images between the treated village (Liboré) and the control village

Bladder lesions	Village	Stage			X^2 and p
Localised hypertrophy		None	One	2 and more	
	Treated	308 (90%)	27 (8%)	7 (2%)	$X^2 = 43.6$
	Control	180 (69%)	64 (24%)	18 (7%)	$p < 10-5$
Bladder irregularity		None	Moderate	Important	
	Treated	324 (95%)	18 (5%)	0 (0%)	$X^2 = 50.3$
	Control	198 (76%)	48 (18%)	16 (6%)	$p < 10-5$
Bladder thickness		Normal	Moderate	Important	
	Treated	320 (93%)	22 (7%)	0 (0%)	$X^2 = 33.8$
	Control	204 (78%)	52 (20%)	6 (2%)	$p < 10-5$
Bladder global index		Stade 0	Stade 1	Stade 2	
	Treated	275 (80%)	60 (18%)	7 (2%)	$X^2 = 85.5$
	Control	119 (46%)	107 (40%)	36(14%)	$p < 10-5$

Table 4 Ultrasonographic renal lesions comparisons between the treated village (Liboré) and the control village (Sébéri)

Renal lesions	Treated village (Liboré)	Control village (Sébéri)	X^2 and p
2 Normal Kidneys	320 (94%)	168 (64%)	$X^2 = 82.9$
A single renal anomaly	22 (6%)	94 (36%)	$p < 10-5$
1 kidney stage I the other stage 0	16 (55)	53 (20%)	
2 kidneys stage I	2 (0.6%)	22 (8%)	
1 kidney stage II the other stage 0	3 (1%)	9 (4%)	
2 kidneys stage II	0 (0%)	4 (2%)	
Total	342 (100%)	262 (100%)	

In 320 (94%) persons the ultrasound appearance of both kidneys were normal in Liboré whereas in Sébéri only 168 (64%) were normal. Twenty two (6%) persons in Liboré and 94 (36%) in Sébéri had a renal abnormality of any type ($X^2 = 82.9$ and $p < 10-5$).

Among 8% of those persons in the control village both kidneys showed stage I abnormalities while only 0.6% were observed in the treated and 2% of people had both kidneys stage II in Sébéri, no stage II were found in Liboré (Table 4).

Results are also clearly different and significant when we observe the right or left kidney either separately or together (following the classification previously described) of patients living in non treated villages and those treated during four consecutive years (Table 4).

Stage III (major hydronephrosis with lack of functional parenchyma) was not observed in either village.

Discussion

After four years of annual selective population chemotherapy in the study village the rate of both bladder and renal ultrasound abnormalities was significantly lower than in a control village with a similar level of prevalence and intensity of infection before treatment was given.

Marked bladder irregularity, marked bladder thickness and moderate hydronephrosis were absent in the treated village after chemotherapy. All other moderate abnormalities of the urinary bladder and lesser degrees renal abnormalities were significantly lower in the treated group. While this study did not permit pre- and post-treatment ultrasound examination of the same cohort the high rate of abnormalities in the control village confirmed the impact of treatment on morbidity. Furthermore, the prevalence of *S. haematobium* infection and intensity of infection (urinary egg count) were significantly reduced after treatment as observed in other studies (Browning et al., 1984; Devidas et al., 1989; Gentilini et al., 1982; Kardaman et al., 1983; Lapierre et al., 1983; Mott et al., 1985).

Therefore, in irrigated Sahelian areas where the transmission of the disease varies according to seasons, we could consider to set up a programme based only on praziquantel chemotherapy without necesseraly having to add a molluscicide treatment with its potentially damaging effects on the environment.

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