Short Communication

Efficacy of single-dose praziquantel on infection and morbidity of *Schistosoma haematobium* in Ijoun, Yewa North LGA, Ogun State, Nigeria

Salami, J.,[1] Oyeyemi, O. T.,[2] Morenikeji, O. A.,[1] Hassan, A. A.,[1] Nwuba, R. I.,[3] Anumudu, C, I.,[3] Jegede, A. S.[4] and **Odaibo, A. B.**[1*]

[1]Parasitology Research Unit, Department of Zoology, University of Ibadan, Ibadan, Nigeria
[2]Department of Basic Sciences, Babcock University, Ilishan Remo, Ogun State, Nigeria
[3]Cellular Parasitology Programme, Department of Zoology, University of Ibadan, Ibadan, Nigeria
[4]Medical Sociology Unit, Department of Sociology, University of Ibadan, Ibadan, Nigeria
*Corresponding author: odaiboalex@gmail.com

Abstract

The study assessed the efficacy of drug therapy on infection due to *Schistosoma haematobium* and associated indicators of infection among school children in Yewa North Local Government Area (LGA), Ogun State, Nigeria. Fresh mid-stream urine samples of 385 school pupils were screened for morbidity indicators (haematuria, protein, bilirubin, urobilinogen and leukocytes) of urogenital schistosomiasis and were further examined microscopically for ova of *S. haematobium*. A total number of 58 subjects randomly selected from the 226 infected population were followed up for 10 weeks post-treatment re-assessment of morbidity. Chemotherapy resulted in reduced prevalence from 58.7% to 2.8% ($p<0.001$) 10 weeks post-treatment. Significant reductions in intensity of infection from 47.6 to 2.9 eggs/10 ml urine was also observed ($p<0.001$). All the indicators of infection tested also showed significant reduction ($p<0.001$) with the exception of proteinuria ($p=0.422$). Sustenance of treatment efficacy and reduced pathology will only be achievable in the area through integrated control strategies.

Keywords: urogenital schistosomiasis, infection indicators, treatment efficacy.

Accepted: 22 December, 2015.

Introduction

Urogenital schistosomiasis caused by *S. haematobium* is a significant cause of clinical morbidity and disability in disease-endemic countries of Africa and the Middle East, where more than 110 million people are infected in the last decade (van der Werf and de Vlas, 2001). Increase in the incidence of schistosomiasis in sub-Saharan Africa has been attributed to proliferation of impoundment schemes and ignorance of the population living in endemic areas (Ekpo and Mafiana, 2004; Adamu, 2010). Schistosome morbidity is mainly caused by eggs trapped in various parts of the human body, depending on the species of schistosomes, hence the fundamental aim of morbidity control is to reduce intensity of infection by drug treatment (Touré *et al*, 2008). Accumulation of parasite eggs in the tissues of the body results in inflammation and granuloma formation causing acute and chronic injury (Chen and Mott, 1989), and long-term infection is associated with increasing structural urinary tract damage, with consequent bladder and kidney dysfunction, and risk of cancer (WHO, 1994; King, 2001).

The mainstay of the current strategy recommended by World Health Organization against the disease is morbidity control through preventive chemotherapy with praziquantel (PZQ) (WHO, 2002; 2006). The strategy in designing a control program for urogenital schistosomiasis in Nigeria and other endemic regions of sub-Saharan African is based on targeting some specific age groups within the endemic communities (usually children aged 5-20 years old) for therapy. The long-term control of the disease in the age-group (school-aged children) with high risk of infection is often difficult to achieve due to re-infection by the parasite after treatment with PZQ. Some policy assessments have suggested that a single-dose praziquantel treatment, given in mid-to-late adolescence (after the period of greatest risk of re-infection), could potentially provide the most cost-effective means of achieving long-term infection-free periods for adult residents (Ouma *et al*, 2005).

Despite the wide application of praziquantel in combating schistosomiasis in endemic countries, there exist, to the best of our knowledge, few or no study on effects of treatment on abnormal urine biochemical

parameters. Since these urine parameters are indicators of severity of infection in endemic areas, their determination in addition to egg outputs after treatment could be used to assess the efficiency or effectiveness of chemotherapy.

In 2010, we began a school-based program for diagnosis and treatment of *S. haematobium* infection in four primary schools in Yewa North LGA, Ogun State, Nigeria. This study summarizes the outcomes of a single dose praziquantel administration on prevalence, intensity and morbidity due to infection by *S. haematobium* in school-based resources in one of the communities (Ijoun) in the LGA.

Materials and methods

Study area

The study was conducted in Ijoun; an endemic community in Yewa North LGA, Ogun State located in latitude 7^0 15′N and longitude $2^0$9′E. The endemicity of the disease was due to lack of good water sources, thus compelling the community's dwellers to depend on water from river bodies for their domestic uses. About two years before the commencement of the study, there was a mass drug administration against schistosomiasis in the community. There are two river bodies in the community (Idi and Isopa) where the snail intermediate host of infection had been observed (Salawu and Odaibo, 2013). The various human water contact activities often observed in the rivers are washing, swimming, bathing and fetching (Salawu and Odaibo, 2014a).

Parasitological examination and indirect diagnosis of S. haematobium infection

Urine samples were collected from 385 pupils of Yewa Central School, Ijoun, at mid-day, i.e., between 10:00 and 2:00 hours. The urine samples were prevented from light penetration to prevent *S. haematobium* eggs from hatching prior examination. Freshly collected urine was visually examined for gross haematuria and then screened semi-quantitatively using chemical reagent strips (Urocolor™ Standard Diagnostics Inc., Korea) for microhaematuria, protein, bilirubin, urobilinogen and leukocytes. Results were scored according to the manufacturer's instructions. Macrohaematuria was scored as positive when urine samples showed frank blood (Ouma *et al,* 2005). The trace concentration 0.2 mg/L of urobilinogen was regarded as negative. Using sterile disposable syringes, well mixed 10 ml of the urine samples were measured and transferred into centrifuge tubes. The samples were subjected to centrifugation at 5,000 rpm for 5 minutes. The supernatant of the urine fluid was removed using dropping pipettes and the sediments were viewed under light microscope for the presence of elliptical shaped *S. haematobium* with terminal spines.

All infected subjects were treated with single dose of praziquantel (40mg/kg body weight) under the guide and monitoring of the research team medical doctor. A total number of 58 subjects were randomly selected from the infected population and were later followed up for post-treatment re-assessment of morbidity and microscopy after 10 weeks of drug administration. The cure rate, egg reduction rate and post-treatment morbidity reduction rate were determined.

Ethical approval

The research protocol was reviewed and approved by the Joint Ethical Review Board of the University of Ibadan/University College Hospital, Ibadan, Nigeria, and the Ministry of Health, Ogun State, Nigeria. Informed consents were sought and obtained from the participating pupils having duly explained the aim and benefits of the study to them. Only pupils whose parents consented were included in the study.

Data analysis

Outcomes for the pre-treatment and post-treatment results for direct and indirect diagnosis were entered and re-checked with the use of desktop computer spreadsheets. Statistical testing was conducted with SPSS version 17.0 Statistical Software (SPSS Inc, Chicago, USA).The geometric mean intensity (GMI) of *S. haematobium* infected individuals was calculated as antilog $[\Sigma \log (x+1)/n]$, with 'x' being the number of eggs/ 10 ml urine (i.e. e/10 ml urine) in *S. haematobium* infected individuals and n the number of positive individuals examined. Student's *t*-test was used to assess significant variation in intensity of infection before and after treatment. Differences in proportion of infection were determined using *chi*-square (χ^2) analysis.

Results

The overall prevalence and intensity of urogenital schistosomiasis before drug administration were 58.7% and 47.6 e/10 ml urine respectively (Table 1). There were significant reductions in prevalence and intensity of infection to 2.8% and 2.9 e/10 ml urine respectively after 10 weeks of treatment with praziquantel, and no viable eggs were excreted. Response to treatment also varied significantly before and after treatment in the two sexes ($p<0.001$) (Table 2). Gender variations in the cure and egg reduction rates showed no significant differences ($p>0.05$).

Table 1. Infection status of urogenital schistosomiasis in school children before treatment.

Age (years)	No. examined	Prevalence (%)	Prevalence (%)	GMI e/10 ml urine
1-5	51	13	25.5	39.5
6-10	163	88	54.0	39.0
11-15	160	117	73.1	59.0
16-20	11	8	72.7	56.4
Total	**385**	**226**	**58.7**	**47.6**

Table 2. Gender response to treatment with praziquantel.

Sex	Intensity (eggs/10ml urine)		Cure rate (%)	Egg reduction rate (%)	*p*-value
	Before	After			
Male	92.2	7.1	93.8	99.8	0.001
Female	42.5	4.0	96.2	99.9	0.001

The result on morbidity assessment before and after treatment was represented in Table 3. Praziquantel administration significantly reduced morbidity due to infection by *S. haematobium.* All the morbidity measured were significantly reduced after treatment ($p<0.05$) with the exception of proteinuria ($p>0.05$). Drug seemed more effective in female subjects than in male subjects as none was found positive to have macrohaematuria, microhaematuria, bilirubin and urobilinogen after treatment. More individuals, positive for protein and leukocytes were however reported in females than in males (Table 3).

Table 3. Morbidity reductions due to treatment with praziquantel.

Indicators	Male % (Mean ±S.E)		Female % (Mean ±S.E)		Overall % (Mean ±S.E)		*p*-value
	Before	After	Before	After	Before	After	
Macrohaematuria	40.6	3.1	15.4	0.0	29.3	3.1	0.001
Microhaematuria	71.9(135.9±20.7)	3.1(0.16±0.16)	61.5(69.2±20.1)	0.0±0.0	67.2(106±15.1)	1.7(0.09±0.09)	0.001
Bilirubin	31.2(0.63±0.17)	0.0±0.0	38.5(0.73±0.2)	0.0±0.0	34.5(0.67±0.12)	0.0±0.0	0.001
Urobilinogen	25.0(0.62±0.13)	0.2±0.0	15.4(0.63±0.21)	0.2±0.0	20.7(0.62±0.12)	0.2±0.0	0.001
Protein	65.4(81.9±22.1)	40.6(11.6±3.5)	84.4(39.2±19.2)	42.3(6.2±1.0)	75.9(62.8±6.9)	41.4(9.1±2.08)	0.422
Leukocytes	31.6(11.11±4.6)	0.0±0.0	54.5(18.2±6.8)	9.1(1.36±1.36)	40.0(13.8±3.81)	3.3(0.52±0.52)	0.003

Discussion

There was a high endemicity of urogenital schsitosomiasis in the area. The value recorded was higher than the recorded 39.1% national prevalence (Schur *et al,* 2011). The prevalence of schistosomiasis recorded among the school-aged children was also higher than the values recorded in other population sectors in the same local government area. For example, 20.8% in pregnant women (Salawu and Odaibo, 2013) and 9.8% in preschool-aged children (Salawu and Odaibo, 2014b). This clearly showed that school children were most predisposed to schistosomiasis.

Praziquantel, a potent anti-schistosomal drug, has been for long advocated for control measures against urogenital schistosomiasis (Davis *et al,* 1979; Omer, 1981). In that respect, knowledge of the kinetics of the output of eggs after praziquantel treatment seems important. In this study, egg excretion showed a drastic reduction within 10 weeks, and output of viable eggs was nil. This decrease was paralleled by a marked reduction of morbidity indicators in urine.

High prevalence of proteinuria after treatment could have resulted from other sources such as increased plasma protein concentration, increased glomerular permeability, defective tubular absorption, abnormal secretion in the urogenital tract (Omer, 1981) and contamination from external body secretions, especially in girls (Barran, 1983). The finding of a higher prevalence of leukocyturia among females after treatment could be due to higher rates of bacteriuria in the female subjects, since leukocytes can be generated in the urine by bacteria. Studies among school-age children have shown that bacteriuria among girls is 30 times the prevalence among boys, and it has been attributed to the fact that girls have a short urethra which predisposes them to ascending bacterial infection (Cooppan *et al,* 1987; Travis and Brouhard, 1996).

One of the factors likely to have contributed to the great impact of treatment demonstrated in the study-area was the high community treatment coverage achieved in a relatively short space of time by the control program. However, sustainable control might be difficult to achieve for a long time in the area because other untreated groups (adult population) are equally at risk of infection couple with cases of imported infection from other neighbouring endemic communities without control intervention. This is typical of a community with poor water development that has to subsist on river water for domestic uses.

A policy review (Gryseels, 1989) has suggested that due to the high frequency of re-infection during childhood and the relative high cost of antischistosomal interventions, a single antischistosomal treatment could be given at age 15 years, which might suffice to eliminate the risk of late disease. The results of our study, which assumed greater benefits from repeated therapies, serve to contradict this single-dose recommendation, and suggest that in the face of recurring infection risk, several treatments during the 10-15-year age period would provide better control of disease in endemic areas (Oniya and Odaibo, 2005; Ouma *et al,* 2005; King *et al,* 2011). In addition, integrated control measures through

transmission control and provision of good water will help to sustain significant reduced infection in communities like ours.

In conclusion, schistosomiasis was highly endemic in the study-community. Praziquantel was highly effective and rapidly reduced egg output and abnormal urinalysis findings. Since re-infection with the parasite is the rule in endemic communities several treatments of age-group with peak egg excretion rate and provision of basic amenities in the area are advocated.

Conflict of interest

There was no conflict of interest in this study.

Acknowledgments

This study was financed by MacArthur Multidisciplinary Grant of University of Ibadan, Ibadan, Nigeria. Many thanks to the Education Authorities of Yewa North Local Government Area of Ogun State, south-western Nigeria, headteachers, parents and pupils of the participating schools for permission to carry out this study.

References

Adamu, T. 2010. Schistosomiasis most prevalent water borne disease in Nigeria. http://allafrica.com/stories/201008200547.html

Ekpo, U. F. and Mafiana, C. F. 2004. Epidemiological studies of urinary schistosomiasis in Ogun State, Nigeria: Identification of high risk communities. *Nig. J. Parasitol. 25:* 111-119.

Barran, M. 1983. Proteinuria. *Br. Med. J. 287:* 1489-1490.

Chen, M. G. and Mott, K. E. 1989. Progress in assessment of morbidity due to Schistosoma haematobium infection. *Trop. Dis. Bull. 86:* R1-R36.

Cooppan, R. M., Schutte, C. H. J., Dingle, C. E., Van Deventer, J. M. G. and Becker, P. J. 1987. Urinalysis reagent strips in the screening of children for urinary schistosomiasis in the RSA. *S Afr. Med. J. 72:* 459-462.

Davis, A., Biles, J. E. and Ulrich, A. M. 1979. Initial experiences with praziquantel in the treatment of human infections due to *Schistosoma haematobium. Bull. Wld. Hlth Org. 57:* 773-779.

Gryseels, B. 1989. The relevance of schistosomiasis for public health. *Trop. Med. Parasitol. 40:* 134-142.

King, C. H. 2001. *Disease in Schistosomiasis haematobia* (Mahmoud, A. A. F. Ed.): *Schistosomiasis.* Imperial College Press, London, 265-296.

King, C. H., Olbrych, S. K., Soon, M., Singer, M. E., Carter, J. and Colley, D. G. 2011. Utility of repeated praziquantel dosing in the treatment of schistosomiasis in high-risk communities in Africa: A Systematic *Review. PLoS Negl. Trop. Dis. 5(l9):* e1321.

Omer, A. H. S. 1981. Praziquantel in the treatment of mixed *S. haematobium* and *S. mansoni* infections. *Arzneimittelforsch, 31:* 605.

Oniya, M. O. and Odaibo, A. B. 2006. Re-infection pattern and predictors of urogenital schistosomiasis among school pupils from a Southwestern village in Nigeria. *Inter. J. Trop. Med. 1(4):* 173-177.

Ouma, J. H., King, C. H., Muchiri, E. M., Mungai, P., Koech, D. K., Ireri, E., Magak, P. and Kadzo, H. 2005. Late benefits 10-18 years after drug therapy for infection with Schistosoma haematobium in Kwale District, Coast Province, Kenya. *Am. J. Trop. Med. and Hyg. 73(2):* 359-364.

Salawu, O. T. and Odaibo, A. B. 2013. Schistosomiasis among pregnant women in rural communities in Nigeria. *Inter. J. Gynecol. Obstet. 122(1):* 1-4.

Salawu, O. T. and Odaibo, A. B. 2014a. Schistosomiasis transmission; socio-demographic, knowledge and practices as transmission risk factors in pregnant women. *J. Parasit. Dis. 40(1):* 93-99.

Salawu, O. T. and Odaibo, A. B. 2014b. Urogenital schistosomiasis and urological assessment of hematuria in preschool-aged children in rural communities of Nigeria. *J. Ped. Urol. 10(1):* 88-93.

Schur, N., Hürlimann, E., Garba, A., Traoré, M.S., Ndir, O. and Ratard, R. C. 2011. Geo-statistical model-based estimates of schistosomiasis prevalence among individuals aged d" 20 years in West Africa. *PLoS Negl. Trop. Dis. 5:*e1194.

Touré, S., Zhang, Y., Bosque-Oliva, E., Ky, C., Ouedraogo, A., Koukounari, A., Gabrielli, A. F., Sellin, B., Webster, J. P. and Fenwick, A. 2008. Two-year impact of single praziquantel treatment on infection in the national control programme on schistosomiasis in Burkina Faso. *Bull. Wld. Hlth. Org. 86:* 780-787.

Travis, L. B. and Brouhard, B. H. 1996. Infections of the urogenital tract. In: Rudolph, A.M., Ed. *Rudolph's Paediatrics. 12th Ed.* Appleton and Lange, Stamford, 1388-1392.

van der Werf, M. J. and de Vlas, S. J. 2001. *Morbidity and infection with schistosomes or soil-transmitted helminth.* Erasmus University, Rotterdam, pp. 1-103.

World Health Organisation. 1994. *IARC Monographs on the evaluation of carcinogenic risks to humans, schistosomes, liver flukes and Helicobacter pylori.* World Health Organization, Geneva.

World Health Organisation. 2002. Prevention and control of schistosomiasis and soil-transmitted helminthiasis. Report of a WHO expert committee. Geneva: *WHO Technical Report Series No. 912*: 1-57.

World Health Organisation. 2006. *Preventive chemotherapy in human helminthiasis.* World Health Organization, Geneva.

Citation: Salami, J., Oyeyemi, O. T., Morenikeji, O. A., Hassan, A. A., Nwuba, R. I., Anumudu, C, I., Jegede, A. S. and Odaibo, A. B.
Efficacy of single-dose praziquantel on infection and morbidity of *Schistosoma haematobium* in Ijoun, Yewa North LGA, Ogun State, Nigeria.
The Zoologist, 13: 72-75 December 2015, ISSN 1596 972X.
Zoological Society of Nigeria.