Full Length Research Paper

Urinary schistosomiasis: Efficacy of praziquantel and association of the ABO blood grouping in disease epidemiology

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Schistosomiasis, one of the neglected tropical diseases continues to plague communities with little or no access to potable water and with high water contact activities. Ipogun village in Ondo State is one of such communities in Nigeria. This study assessed the efficacy of praziquantel and the association of the ABO blood grouping in disease epidemiology in the only private primary school in the village. Ten milliliters of urine and 3 ml of blood samples were collected for urinalysis and blood grouping test respectively from a total of 113 pupils. Results showed that, 60 (53.1%) were infected with *Schistosoma haematobium*. Infected pupils were treated with praziquantel (40 mg/kg body weight) and subsequently re-screened 5 months after the administration of the chemotherapeutic. Results also showed that a single dose of praziquantel conferred a 94.44% cure rate. ABO blood grouping was also observed not to be associated with the epidemiology of the disease as frequency or severity of infection was not significant (p > 0.05) among the three represented blood groups (*A, B* and *O*).

Key words: Urinary schistosomiasis, praziquantel, ABO blood grouping, epidemiology.

INTRODUCTION

Schistosomiasis continues to threaten millions of people, particularly the poor in rural settlements in the developing countries (Chitsulo et al., 2000; Engels et al., 2002). Of all the estimated 200 million infected people globally, more than half are asymptomatic and 20 million exhibit severe disease manifestations (WHO, 1993). Historically, the disease has always been with man. Ruffer (1910) reported calcified eggs in the kidneys of two Egyptian mummies of the twentieth century dynasty.

There are five species of *schistosomes* that can infect humans, of which *Schistosoma mansoni*, *Schistosoma japonicum*, and *Schistosoma haematobium* are the most prevalent ones. While infection with the former two species is associated with chronic hepatic and intestinal fibrosis, infection with *S. haematobium* can lead to ureteric and bladder fibrosis and calcification of the urinary tract (Ross et al., 2002; Utzinger et al., 2001). The other two species, *Schistosoma mekongi* and *Schistosoma intercalatum* are not too common. In Nigeria

and other tropical African countries, two species of these causative organisms have been reported. These are *S. mansoni* and *S. haematobium*, causing intestinal and urinary schistosomiasis respectively with the latter more widely spread (Ejezie et al., 1989). Estimates suggest that 85% of all schistosomiasis current burden is concentrated in sub-Saharan Africa (Chitsulo et al., 2000).

Chemotherapy still remains the principal tool in the global battle against the scourge with Praziquantel being the current drug of choice. Recently, there have been concerns on drug resistance in praziquantel-induced therapy in schistosomiasis. praziquantel resistance has been reported in *S. mansoni*. Ernould et al. (1999) and Doenhoff et al. (2002) discussed the emergence of resistance by *S. mansoni* to praziquantel. Lawn et al. (2003), while expressing the concern on heavy reliance upon praziquantel and the potential development of drug resistance, described a British traveller who acquired *S. mansoni* infection in East Africa and in whom repeated standard 40 mg/kg doses of praziquantel failed to clear the infection despite no opportunity for reinfection. Similarly in *S. haematobium,* King et al. (2001) analysed

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that, attempts to increase community treatment coverage to 100% would accelerate the emergence of clinically significant resistance, and thus emphasized that, targeted treatment has the potential advantage to prolong the useful lifespan of praziquantel.

The blood group frequencies in small inbred populations reflect the influences of genetic drift. In a small community, an allele can be lost from the genetic pool, if persons carrying it happen to be infertile, while it can increase in frequency, if advantage exists (Encyclopædia Britannica, 2007). Though, there is a dearth of information on immunity and/or susceptibility to schistosomiasis vis-à-vis blood group in Nigeria, blood tests are occasionally useful in supporting the diagnosis or assessing the severity of *schistosomiasis* infection. Kassim and Ejezie (1982) reported no significant association between the ABO blood group and *S. haematobium* from two hundred and sixty nine individuals in Epe, Lagos. However, information on this subject remains essential particularly in disease epidemiology, as very scanty data is available. The present study was conducted to assess the efficacy of praziquantel, and the association of the ABO blood grouping in *schistosomiasis* epidemiology, in an untreated population in an endemic community in south west Nigeria.

MATERIALS AND METHODS

The study area

The study was carried out in Ipogun, a village in Ifedore local government area of Ondo State, south west Nigeria. Ipogun ($7^o19`$ N; $5^o05`$E), is about 14 km away from Akure, the capital city. In Ipogun, there is a wet season (April-October) characterized by heavy rains with occasional flooding of river banks and a dry season distinguished by increased temperature, very little or no rainfall and consequently, the river dries up with a few stagnant pockets of water along its course. (November- March). The primary source of water for agrarian and most domestic activities is the 'Aponmu' river, flowing through the village. The inhabitants are mainly farmers who use water from the river in carrying out their daily and recreational activities (bathing and washing).

Ethical considerations, study subjects and collection of samples

Ethical clearance was sought from, and provided by the Ondo State ministry of health. Written informed consent was sought from the parents and guardians of the children before the study began. Results were made known to the parents and all infected children were treated with praziquantel. The pupils of Morohunkeji nursery and primary school, a private establishment in Ipogun were the subjects of the research. The pupils from the school had hitherto not enjoyed any intervention programme in the past from the state's chemotherapeutic control measures. Pupils from primary one to six in the school were all screened. The survey was conducted between November and December 2006, while sample collection to determine the efficacy of the administered drug, praziquantel was subsequently carried out on May, 2007. Urine samples were collected between 09:00 am and 12 noon. Each pupil was given a

clean, dry and labelled screw-capped urine bottle. Five months after initial chemotherapy, urine samples were collected and analysed from the treated pupils to assess the cure rate. Other Information collected from the subjects included name, age, weight, class and gender.

For the purpose of the research, 3 ml of blood was collected from each pupil by venipuncture, with the aid of hypodermic needle and syringe by qualified health workers. This was done after sterilizing the skin surface by dabbing with methylated spirit. The samples were collected into EDTA bottles after which the bottles were shaken to ensure homogeneity, to prevent coagulation. Samples were then taken to the laboratory in cooler boxes for analysis.

Laboratory analyses

Urine

Urine samples were analysed using the centrifugation method as described by Chugh et al., (1986). The samples were left to stand on the bench for about 45 min. Following this, excess samples were decanted before subsequent agitation and pipetting of 10 ml of urine centrifuged 1,500 rpm for 3 min. The supernatant was discarded and the residue was put on a clean glass slide and examined under x10 objective lens of the microscope. Intensity was recorded as geometric mean egg count/10 ml urine. The mean of three separate counts were used for each subject.

Blood

Blood grouping test was done using anti- sera A, B and D reagents (Biotech laboratories Ltd., United Kingdom). The reagents were normally stored at 8^oC, and allowed to attain ambient temperature prior to use. Three drops from each blood sample was placed on a clean white tile. Anti sera were then added and the reactions read to determine the blood group.

Treatment

Chemotherapy: Infected subjects following urinalysis were treated with the standard dose of praziquantel (40mg/kg body weight). The pupils were made to take the drugs in the presence of the village health supervisor, before going back to their classrooms. The drugs were supplied by the Ondo State ministry of health's *Schistosomiasis* control programme.

Statistical analysis

Prevalence rate was determined as the percentage of the infected subjects of the total number of the examined population, and results was further tested using chi square analysis. The geometric mean given as GM= antilog $[\{\sum log(x+1)\}/n]$-1 (Sturrock, 2001) was calculated using Microsoft Excel 2007 in the sex and blood group categories. The test of significance for the blood group relative to the prevalence rate was done with the chi square analysis (x^2) using SPSS version 11 for windows.

RESULTS

A total of 113 pupils were screened, out of which, 60 were found to be infected with *S. haematobium*. This gave 53.1% (Table 1) prevalence in the examined population. About 46.67% (n=25) of this number showed

Table 1. Prevalence and intensity of infection for the urinary *schistosomiasis* among school pupils, in the examined population.

| Gender	No. examined	No. infected	Haematuria (%)	Prevalence (%)	Intensity of infection
Male	59	32	45.16	54.23	16.16
Female	54	28	54.84	51.85	18.64
Total	113	60	100.00	53.10	17.60

χ^2, df = 1, p = 0.001.
There was a significant difference in prevalence of infection within the genders (P<0.05).

Table 2. Prevalence of urinary *schistosomiasis* within age groups among school pupils, in the examined population.

Age (years)	No. examined	No. infected	Haematuria (%)	Prevalence (%)
5	1	0	0.00	0.00
6 -10	94	49	64.52	52.13
11-15	18	11	35.48	61.11
Total	113	60	100.00	53.10

χ^2, df = 1, p = 0.001.
There was a significant difference in prevalence among the age groups (P<0.05).
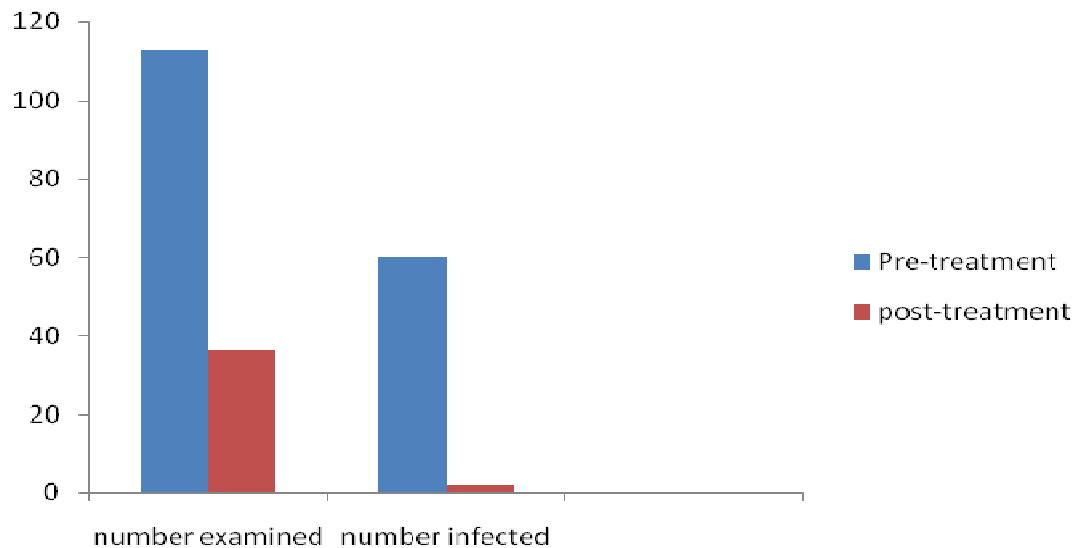
Figure 1. Prevalence of infection in the examined population post-treatment with praziquantel.

positive *haematuria* before centrifugation while 10% (n = 6) showed only after centrifugation. The geometric mean intensity of infection was 18.64 (Table 1) among the female pupils, while 16.16 was recorded for male.

Disease prevalence was highest (61.11%) within the age group 11 - 15 years and this was significant (p < 0.05) (Table 2). In this age group is also recorded the highest cases of *haematuria* (64.52%). Chemotherapy, using praziquantel was employed in treatment and control of infection. This anti-*schistosomal* drug was administered on a total of 36 pupils who agreed to continue with the programme from the initial 60 positive

cases. The outstanding 24 pupils were either absent from school or refused to be treated. The drug was administrated according to subject's body weight (40 m g/kg). Only 2 of this number tested positive after 5 months of the treatment giving 94.44% cure rate for praziquantel (Figure 1).

A total of 64 blood samples was also collected out of which 17 were 'A', 11 were 'B' while group 'O' recorded 36. Group 'AB' on the other hand was absent from the entire sampled population. Intensity of infection among infected pupils in the blood groups was 12.95, 15.18 and 14.45 (Table 3) for blood groups 'A', 'B' and 'O'

Table 3. Blood group specific prevalence of urinary schistosomiasis among school pupils in the examined population.

Blood group	No. examined	No. infected	Percentage prevalence (%)	Intensity of infection
A	17	10	58.82	12.95
B	11	6	54.55	15.18
O	36	24	66.67	14.45

χ^2, df = 2, p = 9.15.
There was no significant difference in prevalence within the blood groups (p>0.05).

respectively. There was no significant difference (p > 0.05) in relation to prevalence of infection.

DISCUSSION

The prevalence of urinary *schistosomiasis* was considerably high in the screened population, since more than half (53.10%) suffered from infection with 56.65% of the infected having visible *haematuria*. The high proportion in prevalence, observed in the screened population may be an indication that most villagers still frequent the stream for their daily activities, occupational or recreational purposes.

Gender specific prevalence revealed that the number of male pupils infected was slightly higher (54.23%), though significantly, than females (51.85%). This observation may be due to the fact that males are more involved in activities that have to do with water contact e.g. swimming, washing, and irrigation.

Pupils in the village have been reported to have more frequent contact with fresh water from 'Aponmu' stream during recreational activities such as swimming (Oniya, 2007). The observed prevalence along age group showed that age group 11 - 15 years had the highest prevalence of infection (61.11%), while 52.10% was recorded for age group 6 - 10 years and no infection was found in the 5 years old. Those in age group 11 - 15 years were obviously mostly affected probably because they frequently indulge in activities that bring them in contact with the source of infection. Frequent water contact activities by this age group may also promote transmission potential in the community. Furthermore, disease prevalence was higher in male pupils (54.23%) than the female with 51.85%. Intensity, however, was higher in the female population (18.64) and lower in the male pupils (16.16). Prevalence generally seems not to determine the worm load in the screened population as also shown in the blood group specific prevalence compared with the intensity.

From the results (Table 3), blood group O was predominant in the population with 56.25% of the pupils in this blood group. Blood group A was 26.56% while 17.19% individuals belonged to blood group *B*. There was higher prevalence of infection among individuals of blood group O, where 66.67% prevalence was recorded, this was followed by 58.82% prevalence from blood

group *A* and 54.55% from blood group *B*. *AB* blood group was absent from the screened population. Similar results were observed by Kassim and Ejezie (1982) and Ndamba et al. (1997). They later reported highest prevalence rates among individuals of blood group O (61.30%), 60.80% for blood group A, and 53.80% for blood group B, while blood group AB was altogether absent in a population screened for *schistosomiasis* in East Africa. Though we report the highest intensity and infection rates in the blood group O, our findings also showed that, there was no significant association between disease prevalence and ABO blood grouping in the examined population.

The efficacy of praziquantel treatment was very high in the studied population as the prevalence of *S. haematobium* dropped to 5.56%, without any case of *haematuria*, in the treated population after 5 months of chemotherapeutic administration (Figure 1). This gave 94.44% efficacy or cure rate for praziquantel. The examined population had not enjoyed any control coverage programme from the government as it was a privately owned school as opposed to the other public schools in the village, which had benefited from previous chemotherapeutic intervention programmes (Oniya and Odaibo, 2006; Oniya, 2007). The likelihood of reinfection is also high in the treated population as abstinence from the transmission sites cannot be guaranteed.

Presently, disease control is principally centred on chemotherapy, this alone cannot solve the problem (Sturrock, 2001). The rate of reinfection following parasitological cure is another concern for a multi pronged approach.

Chemotherapy alone may not be sufficient for the eradication of the disease as long as the intermediate hosts persist. Even in the previously untreated population, 100% cure rate was not recorded and with the growing concerns of the predicted failure of praziquantel (King et al., 2000 and 2001), an integrated control approach is desirable, to prolong the efficient use of praziquantel. There is also an urgent need for state and local governments in endemic countries to show genuine political commitment in order to halt transmission in their endemic communities. Such designs should however be implemented over a five years uninterrupted period.

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