Acta Medica et Biologica
Vol. 44, No. 4, 215-219, 1996

Concurrent Infections with Schistosomiasis, Typhoid Fever and Malaria among Patients in Edo State, Nigeria

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Received December 4 1995; accepted August 29 1996

Summary. **The prevalence of typhoid fever, malaria and schistosomiasis among 268 symptomatic patients in Edo State, Nigeria, was investigated. Blood, urine and stool samples were collected from 268 patients (163 males and 105 females). The results showed that of the total number examined, 65 (39.9%) males and 39 (37.1%) females had schistosome eggs in their urine. Ninety-five (58.3%) males and 67 (63.8%) females were infected with *Salmonella typhi*, while 88 (54.0%) males and 54 (51.4%) females had malaria parasites. Dual infections of schistosomiasis and typhoid fever were higher in females (17.14%) than males (16.6%). Thirty-three (20.3%) males and 24 (22.86%) females had both schistosomiasis and malaria. Typhoid fever and malaria occurred in 53 (32.5%) and 35 (33.3%) males and females, respectively. Triple infections with typhoid fever, malaria and schistosomiasis occurred among 16 (9.8%) males and 13 (12.4%) females. For all cases, children were more frequently infected than adults. This study provide insight into problems and complications in tropical diseases as dual or triple infections could occur concurrently in a patient.**

Key words—schistosomiasis, typhoid fever, malaria, Nigeria.

INTRODUCTION

A relationship has been found to exist between schistosomiasis and typhoid fever.[1,2] The interaction of salmonellae and schistosomes in host parasite relations has also been reported.[3] It has been observed that *Salmonella typhi*, the causative agent of typhoid fever, resides on the cuticle of *Schistosoma* species.[1,2] Typhoid fever or *Salmonella* infection was also reported to be clinically prolonged by schistosomiasis or bilharziasis in one out of three patients, and that both infections must be treated concomitantly.[1,2] Martinelli et al.[4] also observed that prolonged *Salmonella* bacteremia caused the exacerbation of a pre-existing sub-clinical schistosomal glomerulopathy by the addition of active lesions directly related to the prolonged bacteremia. Furthermore, it was asserted that all patients in a particular group of their study experienced remission of their clinical and laboratory abnormalities as the *Salmonella* infection was cured. Prolonged *Salmonella* bacteremia in patients with *Schistosoma mansoni* infection was also reported by Rocha et al.[5] *Schistosomiasis*, among many factors, may contribute to death from typhoid fever because it reduces immunity.

The association between malaria and schistosomiasis has also been reported.[6] Among 377 school children infected with *Schistosoma* species, 59.7% had concurrent malaria. Malaria and typhoid fever often manifest similar symptoms including fever, abdominal pains, headache, weakness and vomiting.[7] As a result, some physicians tend to mistake typhoid fever for malaria, and treatment for typhoid is considered only when the treatment for malaria is not effective. In a study involving an algorithm for the clinical differentiation of malaria and typhoid, thirty-five patients with culture-positive typhoid and fourty-nine with blood-slide-positive malaria were enrolled.[7] The odds of typhoid were increased most in patients with altered bowel habits, an illness of more than two weeks duration, tremors or the presence of typhoid facies. The odds of typhoid were lowest in patients with pallor or jaundice.[7] The clinical diagnostic

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algorithm derived based on these finding showed over 70% sensitivities and specificities in diagnosing both malaria and typhoid. This study by Richens et al.[7] highlighted the strong association between malaria and typhoid, the problems inherent in their clinical differentiation and the need for both infections to be considered or treated concomitantly.

It is therefore established that a possible relationship exists among schistosomiasis, typhoid fever and malaria, although this has not been elucidated in our environment. The implication of this relationship is that in areas where the triple infections co-exist, controlling one may influence the course of the other or exarcerbate the other.[6] Based on this background, previous reports emphasized the need for further research on disease interrelationships as this would be of practical importance with respect to disease control and prevention in different parts of the world.

In Nigeria and other African countries, little is known of the incidence of concurrent infections with schistosomiasis, typhoid fever and malaria despite the severity of the diseases on the African continent.[8-12] Consequently, the purpose of this study was to provide base line data on concurrent infections of these triple diseases for clinico-epidemiologic purposes and for the subsequent enhancement of their management and control.

MATERIALS AND METHODS

Samples of stool, urine and blood were collected from 268 patients (163 males and 105 females) with symptoms of malaria, typhoid fever and schistosomiasis at Iruekpen General Hospital, Iruekpen; University Health Centre and Calvary Foundation Clinic, Ihumudumu, all in Ekpoma, Edo State, Nigeria. Samples were also collected from school children in the Ikpeshi District of the Akoko-Edo area of Edo State where hospital facilities are lacking.

For the detection of *Schistosoma haematobium* ova in urine specimens, specimens were centrifuged at about 2,000 rpm for 3 min The supernatant was then fixed on a clean slide and stained using methylene blue. Stained smears were later examined for the characteristic pale-yellow ova possessing terminal spines peculiar to *Schistosoma haematobium*.[13] For the malaria parasites, thin and thick films were made from blood samples using standard procedures.[12]

Screening for antibody to *Salmonella typhi* was done using the Widal test, and a titre above 1 in 80 (1/80) was taken as significant according to the standard recommendation.[14] Further tests involved the isolation of the causative organism *(Salmonella)* using previously reported methods.[15] A definitive diagnosis of *Salmonella typhi* was achieved by using a combination of Widal reaction and final bacteriological detection and the identification of *Salmonella typhi*.

RESULTS

Of a total number of 268 patients screened for the prevalence of *Schistosoma haematobium* eggs, 104

Table 1. Age and sex distribution of schistosomiasis, typhoid fever and malaria infections among 268 patients

Age groups	Schistosomiasis		Typhoid fever		Malaria		No. of original population	
	M	F	M	F	M	F	M	F
5-10	9	3	6	4	4	3	14	8
11-15	56	31	34	20	31	20	63	39
16-20	—	1	4	1	8	1	20	6
21-25	—	4	13	7	10	10	13	12
26-30	—	—	13	11	11	9	18	13
31-35	—	—	2	7	4	2	6	7
36-40	—	—	8	7	8	4	10	8
41-45	—	—	12	9	10	5	12	10
46-50	—	—	2	—	2	—	4	—
51-55	—	—	1	1	—	—	3	2
Total	65/163	39/105	95/163	67/105	88/163	54/105	163	105
% Infection	39.9	37.1	58.3	63.8	54	51.4		

Tabel 2. Simultaneous occurrence of schistosomiasis and typhoid fever (STF), schistosomiasis and malaria (SM), and typhoid fever and malaria (TFM) infections among screened individuals

Age groups	STF		SM		TFM	
	M	F	M	F	M	F
5-10	1	—	6	3	1	4
11-15	26	18	27	21	17	12
16-20	—	—	—	—	5	1
21-25	—	—	—	—	7	3
26-30	—	—	—	—	8	8
31-35	—	—	—	—	2	2
36-40	—	—	—	—	5	2
41-45	—	—	—	—	7	3
46-50	—	—	—	—	1	—
51-55	—	—	—	—	—	—
Total	27/163	18/105	33/163	24/105	53/163	35/105
% Infection	16.6	17.14	20.2	22.86	32.5	33.3

(38.8%) were found to be infected, of which 65 were males and 39 were females (Table 1). The incidences among males and females were 39.9% and 37.1%, respectively. Age distribution of infection showed that 12 patients (9 males and 3 females) of those infected were 5-10 years of age. For malaria parasites, mainly *Plasmodium falciparum* and *Plasmodium malariae*, a total number of 142 (53%) were found infected. Of this number, 88 (54%) were males and 54 (51.4%) were females out of a total number of 163 males and 105 females screened. In all the age groups infected with malaria parasites, the highest infection rate was within the age range of 11-15 years, with 31 males and 20 females being infected. Infection with *Salmonella typhi* was observed in all the age groups examined, and the ages between 11-15 years were found to be more infected (34 males and 20 females).

Patients were also screened for simultaneous infection with schistosomiasis and typhoid fever as shown in Table 2. Only one male within the ages of 5-10 years was found to be infected, while between 11-15 years, 26 males and 18 females were infected.

The survey revealed 57 cases of dual infection with schistosomiasis and malaria. Dual infection was observed only in age ranges between 5-10 and 11-15 years. (Table 2).

Almost all the age groups were infected with both typhoid fever and malaria. A total number of 88 comprising 53 males and 35 females was observed. The infection rate was the highest for the age group between 11-15 years. Results on triple infections with schistosomiasis, typhoid fever and malaria are presented in Table 3. Simultaneous prevalence of the triple diseases occurred in 16 (9.8%) males and 13 (12.4%) females. Among 163 males and 105 females screened, individuals infected were within the age groups of 5-10 and 11-15 years, respectively.

Table 3. Simultaneous prevalence of the trio of schistosomiasis, typhoid fever and malaria among screened individuals

Age groups	Males	Females
5-10	1	3
11-15	15	10
16-20	—	—
21-25	—	—
26-30	—	—
31-35	—	—
36-40	—	—
41-45	—	—
46-50	—	—
51-55	—	—
Total	16/163 (9.8%)	13/105 (12.4%)

DISCUSSION

This study has successfully demonstrated the incidence of concurrent infections with schistosomiasis, typhoid fever and malaria among patients in Edo

Stage, Nigeria. The study is also unique and significant because we are not aware of any literature on the simultaneous prevalence of these triple infections among patients in Nigeria. Our results on concurrent infections with these diseases are in harmony with previous reports,[1,5-7] and confirm the synergisms between schistosomiasis and other diseases such as malaria and typhoid fever prevalent in endemic areas that generally worsen the overall condition of the patient.[2,4,5] Schistosomiasis has been reported to be associated with cancer,[16] malaria and typhoid fever.[5,6,7] Although these conditions may not have been caused by schistosomes, it is possible that other disease conditions could be exacerbated by concomitant schistosome infections.[4,5] For example, schistosomiasis has been reported to suppress malaria parasitaemia.[6] Schistosomiasis may enhance the activity of the reticulo-endothelial system and cause a more rapid clearance of infected red blood cells. The implication of this inverse relationship is that, in areas where both infections co-exist, controlling one may exacerbate the other.[6]

Our results also indicated that males were more frequently infected than females for cases of malaria, typhoid fever and schistosomiasis. These observations are consistent with the reports of Nwaorgu and Anigbo[9] and Young et al.[3] Gender-specific schistosomiasis or female genital schistosomiasis has been reported.[17,18] Feldmeier et al.,[18] while highlighting the individual and public health hazards of female genital schistosomiasis, asserted that the disease could be a possible cofactor for the spread of the human immunodeficiency virus.

The prevalence of dual infectios of schistosomiasis and typhoid fever, schistosomiasis and malaria, typhoid fever and malaria as well as concurrent infections with the triple diseases were also observed to be associated with males and females with almost equal frequency.

We cannot adduce any specific reason for these cases in males and females, but we speculate that the frequent contacts of males and females with water (rivers) due to water-related occupations such as fishing may partly explain it. Infections with typhoid fever, malaria and schistosomiasis were highest among the 11-15 year age group. It may be explained by the fact that this age group (11-15 years) are more active in domestic activities such as fetching water from the river or washing clothes near the bank of the river where they may be exposed to mosquito bites and snail intermediate hosts of schistosomes. However, the lower prevalence rate in adults could be due to the presence of an immunity to schistosomiasis.

It could be deduced from the findings of this survey that the nearness of the towns to rivers, the climatic condition of those places which favour farming activities, and poor water supply coupled with lack of personal and environmental hygiene especially, created avenues for breeding of mosquitoes, the survival of snail intermediate hosts of schistosomes and the effective transmission of *Salmonella typhi*. Therefore, there is a need to educate members of the community on the importance of personal hygiene as well as the use of anti-malaria and anti-schistosomal drugs when infection has been reported. Adequate and good water supply sources should be provided to avoid water contact with infested streams.

It is also recommended that physicians, while treating for either typhoid fever or malaria infections, should request laboratory tests for both illnesses for more effective management. Also, when cases of typhoid fever are being managed, it may be necessary to screen for schistosomes, especially in endemic areas since both infections have been documented to co-exist in an individual.

We conclude that the demonstrations of concurrent infections of the triple diseases among patients should alert physicians to the intricate and extended management of any of these diseases, especially in their areas of endemicity.

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