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Prevalence of Urinary Tract Infection (UTI) and Concomitant Urinary Schistosomiasis among Primary School Children in Remo North Local Government, Ogun State, Nigeria.

Kehinde J.Amoo[1], Oladipupo A.J. Amoo[1], Adewale A. Oke[2], Tope T. Adegboyega[3]
[1]*Department of Medical Mcrobiology & Parsitology, Olabisi Onabanjo UniversityTeaching Hospital,Sagamu. Nigeria.*
[2]*Department of Biological Sciences, College of Natural Sciences, Redeemer's University, Ede. Nigeria*
[3]*Department of Biological Sciences, Faculty of Pure & Applied Sciences,SouthWestern University,Oku,Okun-Owa. Nigeria)*
*Corresponding Author: *Kehinde J. Amoo*

***Abstract*:** *The urinary tract infection (UTI) which affects any part of the urinary tract is one of the most common paediatric infections that may cause permanent kidney damage. The most common causative organisms are bowel flora. Schistosomiasis, a neglected parasitic tropical disease is one of the major public health problems facing developing countries. School-aged children are at the greatest risk of acquiring Schistosomiasis. The complexity of Schistosomiasis morbidity is associated with its co-infection with bacteriuria. Against this background, current information on the prevalence of urinary Schistosomiasis, as well as associated bacteriuria co-infection is necessary for effective control of the disease. We therefore investigated the current prevalence of urinary Schistosomiasis and co-infection with bacteriuria in Ishara in order to provide information for public health action. 280urine samples were collected and cultured on the appropriate media. Urinalysis and microscopy were also conducted on the samples. Isolated organisms were identified by standard biochemical tests.91(32.5 %) samples were positive to urine culture [61(38.1%] for females and 30(25%) for males. Escherichia coli have the highest occurrence (33%). However, out of 280 pupils, 68 (24.3%) had urinary Schistosomiasis [Male- 40(33.3%), Female - 28(17.5%)] and 54(79.4%) out of the 68 with urinary Schistosomiasis had bacteriuria.The study showed a significant relationship between the urinary Schistosomiasis and bacteriuria among the subjectsand thus an urgent need for renewed control measures against Schistosomiasis and concurrent bacteriuria among the school age group in the country.*

Keywords: *Schistosomiasis, Urinary tract infection, School-aged children,*

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I. Introduction

Urinary tract infection (UTI) is the presence of microorganism in the urinary tract which is naturally sterile [1]. UTI, which is normally caused by bacterial infection, affects any part of the urinary tract particularly the kidneys, which make urine; ureters, tubes that carry urine from the kidneys to the bladder; the bladder, which stores urine until the body is ready to empty it; and the urethra, the tube that carries urine from the bladder out of the body [2].Urinary tract infection (UTI) is one of the most common paediatric infections. It distresses the child, concerns the parents, and may cause permanent kidney damage [3, 4]. Prompt diagnosis and effective treatment of a febrile UTI may prevent acute discomfort and, in patients with recurrent infections, kidney damage. The 2 broad clinical categories of UTI are pyelonephritis (upper UTI) and cystitis (lower UTI). The most common causative organisms are bowel flora, typically gram-negative rods. *Escherichia coli* is the organism that is most commonly isolated from paediatric patients with UTI [4]. However, other organisms that gain access to the urinary tract may cause infection, including fungi (*Candida* species) and viruses [1].

Microbial invasion being the basis of urinary tract infection could be seen in various clinical manifestations resulting into various disease conditions in both males and females. These disease conditions include pyelonephritis which was shown to be non-age discriminatory as it affects both older person and infants with age range of 2 weeks to 18 years [5]. The urinary tract infections (UTI) have been reported to be the most commonly encountered bacterial infections that pose a health threat to infants and children [6, 7]. The prevalence of urinary tract infection in acutely ill children in general practice is unknown. UTI in young children is difficult to diagnose and many cases are probably missed [8, 9]. The challenge is that young children with UTI often present with non-specific symptoms that are also present in non-specific illness and in many other common conditions [3]. Clinicians may therefore not consider the diagnosis or obtain a urine sample [10,

11]. Childhood UTI has been associated with renal scarring and serious long-term complications, including hypertension, pre-eclampsia, and renal failure [1,12]. A systematic review found renal scarring was present in approximately 15% of children following a first UTI [13]. It remains unclear exactly what causes renal scarring to develop in some children, or which groups of children are most at risk. There is some evidence that even children without fever or those with a self-limiting UTI may nevertheless be at risk of renal scarring [14].

Schistosomiasis, a neglected water-borne parasitic infection caused by a trematode of the genus *Schistosoma*, is one of the major public health diseases common in rural areas of developing countries [15-17]. Though it affects all ages, school-aged children are at the greatest risk of being infected with Schistosomiasis with the boys more affected than the girls [18, 19].

The disease exists in two major forms, the intestinal form occurring through infection by Schistosomamansoni, japonicum, intercalatum or mekongi, causing bloody stool and ascites, and the urinogenital form caused by infection with Schistosomahaematobium resulting in haematuria. In many developing countries in Asia, Africa, and South America Schistosomiasis is mostly found in areas where the water contains fresh-water snails such as Biomphalaria and Bulinus, their aquatic intermediate hosts [20]. Across the globe over 200 million infections occur annually with Africa accounting for over 97% of the Schistosomiasis burden and up to 800 million people being at risk in areas where sanitation and water hygiene is poor [16,21].With an estimated 25.83 million people infected Nigeria is regarded as the most endemic country in the world for urinary Schistosomiasis. A study conducted in 1989 within a focal community in Enugu state in south eastern Nigeria revealed a 79% prevalence of urinary Schistosomiasis [17].

The co-infection of urinary Schistosomiasis and urinary tract infection in children is confounded and had been previously documented. The mechanism of the relationship of the urinary Schistosomiasis with other infectious diseases including urinary tract infection is incompletely understood [22] but it is believed that the break-down of mucosal barrier occurring with urinary Schistosomiasis could aid the colonisation of the urinary tract by the invading bacteria. Systematic knowledge about bacterial co-infection and Schistosomiasis in the 5-15years age group is scanty which is understandable since methods for Schistosomiasis surveys are not optimal for detecting bacteriuria [23]. Even with many studies implicating this co-infection in the aetiology of bladder cancer and other terminal complications [24] it have been shown that such squamous cell carcinoma of the bladder, hypertension and even end-stage renal disease may take between 10-20 years after initial co- infection to develop [25,26].By experiment compounds like N-butyl-N-(4-hydroxy butyl) nitrosamine (BHBN) and N-methyl-N-nitro-urea (NMU), which are produced from amine precursors and nitrate in urine during the bacterial infections are known bladder carcinogens [24]. Against this background, there is therefore an urgent need for a renewed commitment to control Schistosomiasis and concurrent bacteriuria among the school age group in the country. Novel preventive measures and clinically important and adequate information on the urinary Schistosomiasis and the associated bacteriuria co-infection is urgently needed to effectively control the diseases and thus preventing subsequent complications. Hence, this study is designed to determine the prevalence of Schistosomiasis and secondary urinary tract infection with the aetiologic agents among school children in Isara Remo North Local Government, Ogun State, Nigeria.

II. Materials And Methods

2.1 Ethical Clearance

Ethical approval was obtained from the Medical Ethical Research Committee and Ogun state Ministry of Education Science and Technology.

2.2 Study place

Study Population: The study was carried out in Remo North local government, Ogun State, Nigeria, between July and December, 2015. The study area is the rural area of the local government where there is no access to pipe-borne water. Children that are apparently healthy and attending primary school (5-14years) were selected for this study.

Eight primary schools were selected, from which a total of 280 samples were obtained. Equal numbers of samples from the schools in which one hundred twenty (120) samples were collected from males and one hundred sixty (160) samples were collected from females. Pupils who participated in the study were selected at random, from each primary school. The inclusion criteria was children attending primary schools only, while the exclusion criteria were children below or above primary school age and those that had recently used antibiotics.

2.3 Study design and methodology

Materials

Sterile universal bottles, Olympus Microscope, Grease free slide, Glass Cover Slip Sterile Petri-dish, Urinalysis Strip- Combi 9 (Medi-Test Combi 9®SGL), Agar such as Blood Agar, Mac Conkey agar, Cysteine Lactose Electrolyte Deficiency (CLED).

Methods

Questionnaire

Questionnaires were used to generate data for this study. They were sent to parents and guardians of all the participating children. The key areas addressed in the questionnaire include recent use of antibiotics, nocturnal enuresis (bedwetting) and previous history of urinary tract infections (UTI).

Sample Collection

Urine samples were collected using sterile universal bottled well-labelled by the most recommended method of urine sampling in children above the age of three.

After collection, the clean catch mid-stream urine sample in sterile containers was transported immediately to the Microbiology of South-western University Nigeria, OkunOwa for analysis. Samples were stored in refrigerator at 4-8^{0}C when delay in processing could not be made. The samples were taken to the laboratory for microscopy and culture.

Urinalysis

Analysis of urine samples was conducted using multi stick of Medi-Test Combi 9®SGL -a form of dipstick screening technique to determine the presence of blood in urine.

Urine microscopy

About 10 ml terminal urine sample was centrifuged at 2000 rounds per minute (rpm) for 3 minutes in order to concentrate egg of the Schistosome. The deposit was examined microscopically using the x40 objectives for the characteristic eggs as described by Cheesbrough [27]. Pus cells and red blood cells in samples were also noted.

Microbiological analysis

Each sample was cultured on Mac Conkey agar, Cystein Lactose Electrolyte Deficient (CLED) agar and Blood agar as described by Vandepitte*et a*l and Cheesbrough [27, 28]. Incubation was carried out for 24hours at 37^{0}C. Enumeration of colonies was carried out as described by Younis*et al* and cultures with cfu/ml considered significant [29].

Bacterial culture and isolation

Using a calibrated wire loop capable of delivering 0.01mlof urine, each sample was inoculated on blood, MacConkey and Cystine lactose electrolyte-deficient (CLED) agar respectively and incubated aerobically for 18 - 24 hours.

A semi-quantitative method was used to determine the colony counts and significant bacteuria was defined as pure bacterial culture of $\geq 10^5$ colony forming units/ml ($\geq 10^5$ CFU/mL) of urine. Isolated organisms were identified by standard biochemical tests.

Biochemical Tests

These were conducted from plates with positive result as described by Presscott [30] and Cheesbrough [27] to identify individual organism.

Grams Stain

The use of the Gram stain divides bacterial isolates into two classes - gram-negative and gram-positive.

Coagulase Test:

This is done to test for the presence of coagulase which causes plasma to clot by converting fibrinogen to fibrin. It is to identify coagulase positive Staphylococcus species.

Slide and Tube methods were conducted. Before confirming as negative, all slide tests, which were coagulase negative, were re-checked using the test tube method.

Oxidase Test:

The oxidase test was used to assist in the primary identification of Pseudomonas species, which produce oxidase enzyme.

Indole Test

Testing for indole production is important in the identification of Enterobacteria e.g. *Escherichia coli*, which breakdown the amino-acids tryptophan with the release of indole.

All the tests (Gram Stain, Coagulase, Oxidase and Indole Tests were conducted as previously described [27, 30].

III. Results

A total of 280 urine samples were taken from primary school pupils voluntarily with the support of their parents and teachers. |Out of the one hundred and twenty (120) male samples 30(25.0%) were infected, 160 female samples while out of 160, 61(38.1%) were infected. Out of 280 urine samples analysed, 91(32.5 %) samples were positive to urine culture [61(38.1%) for females and 30(25%) for males (Tables 1 and 2). *Escherichia coli* have the highest (33%) occurrence (Table 3). However, out of 280 pupils, 68 (24.3%) had urinary Schistosomiasis [Male- 40(33.3%), Female - 28(17.5%)] and 54(79.4%) out of the 68 with urinary Schistosomiasis had bacteriuria (Tables 4 and 5).

Table 1. The Incidence of Urinary Tract Infections (UTI) In Relation To Sex of Primary SchoolChildren

SEX	TOTAL	POSITIVE	Positive (%)	NEGATIVE	Negative (%)	P value
Male	120	30	25	90	7	
Female	160	61	38.1	99	61.9	
Total	280	91	63.1	189	68.9	0.014

Table 2. The Incidence of Urinary Tract Infections (UTI) In Relation To Age of Primary School Children

Age Group (Years)	MALE			FEMALE		
	No. Examined	No. Infected	% Infected	No. Examined	No. Infected	% Infected
< 10	35	06	17.1	45	12	26.7
10 – 12	45	15	33.3	63	21	33.3
13 – 15	30	09	30	37	18	48.7
>16	10	-	-	15	10	66.7
TOTAL	120	30		160	61	

Table 3. Bacteria Species Isolated and Identified From Urine Culture

Organisms Isolated	Colony count CFU/ml x 10^5	No. of Occurrence	% Occurrence
Staphylococcus aureus	25	25	27.5
Proteus species	5.2	6	6.6
Klebsiella species	36	6	6.6
Escherichia coli	8.1	30	33.0
Pseudomonas aeruginosa	10	15	16.5
Streptococcus species	3.9	9	9.9
TOTAL		91	

Table 4**. Relationship between the Occurrence of Schistosomiasis and Age**

Age group	No. of students	No. Positive to ova of *Schistosomahaematobium*	% Positive
< 10	80	09	11.2
10 – 12	108	25	23.0
13 – 15	67	30	44.8
>16	25	04	16.0
TOTAL	280	68	24.3

Table 5. Relationship of Bacteriuria and Urinary Schistosomiasis among Primary School Children by Gender

	Male =120			Female =160		
Age (Years)	Ova present	Ova present with bacteriuria %	Ova absent with bacteriuria	Ova present	Ova present with bacteriuria %	Ova absent with bacteriuria
< 10	05	03 (60%)	03	04	02 (50.0%)	10
10-12	12	08 (66.7%)	05	13	11 (84.6%)	08
13-15	10	10 (100%)	_	20	17 (85.0%)	06
> 16	01	01 (100%)	_	03	02 (66.7%)	5
Total	28	22	08	40	32	29

Table 6. Relationship between Urinary Tract Infections (UTI) and Bedwetting

Bedwetting	No. of Students	UTI occurrence	% Occurrence	P. Value
Yes	30	12	40.0	
No	250	79	31.4	
TOTAL	280	91	71.4	0.809

IV. Discussion

Among the 280 pupils 25% (30) and 38.1% (61) of the male and female respectively had urinary tract infection. The occurrence of UTI among these children as related to sex was not significantly associated (P =0.014). It could therefore be said based on this study that the occurrence of UTI among the children did not have gender preference. However in the age group >16 years 66.7% among the female had UTI while none was found in their male counterparts of the same age group. Thus UTI prevalence was gender specific at older age group among the females. The developmental changes in the females as they reach puberty could be responsible for this as sexual activity has been regarded as a risk factor for the development of UTI in young women [4]. Out of 280 pupils, 68 (24.3%) had urinary Schistosomiasis [Male-40(33.3%), Female - 28(17.5%)] and among those infected with urinary Schistosomiasis 54(79.4%) had bacteriuria.

In this study the peak of infection of Schistosomiasis was among the age group 13-15 years (44.8%) which was different from some previous studies in Nigeria, likeMorenike et al. where the peak of infection was at 8-10 years among children in Ogun State, south-western Nigeria in 2011 [17]. It could not be satisfactorily concluded in this study that the occurrence of the infection is gender-specific though the rate of infection among the age group 13-15 years is almost double the rate among the age group 10-12 years.Concomitant UTI resulting from urinary Schistosomiasis is known to be prevalent in Schistosomiasis endemic areas. 79.4% co-infection of urinary Schistosomiasis and UTI represent a high rate and the association could be therefore considered significant in this study where just about 32.5% of the study population had UTI. This result strongly supports prior works concluding that Schistosomiasis highly increases susceptibility to UTI.

Co-infection by bacteria and*Schistosomahaematobium* could necessitate the development of new prophylactic and curative therapeutics for such situation.In previous studies the presence of *Schistosomahaematobium* ova being significantly associated with high prevalence of bacteriuria has been documented though a number of studies have disputed this link [17, 22].

As the mechanism of *Schistosomahaematobium*- bacterial urinary tract co-infections is not fully understood there is need for deeper study of social characteristics, environmental and also biological interactions.The association between UTI and bedwetting could not be established in this study as there was no significant correlation (P = 0.809) with the percentages of the infected and non-infected children bedwetting almost the same (Table 6). Thus UTI does not predispose to bedwetting.*Escherichia coli, Pseudomonas aureginosa and Staphlococcusaureus* were the most isolated organism in that order (33%). This is in agreement with many previous studies indicating the highest occurrence of *Escherichia coli* isolation [6].

V. Conclusion

This study helped to acknowledge the need to screen the school children with Schistosomiasis for urinary tract infection due to their established co-infection thus providing information to help in proper management of such cases. A pragmatic and consistent approach in eliminating the burden of the disease (Schistosomiasis) is very important. Therefore adequate public awareness and control strategies have to be put in place by the concerned authorities.

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