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Symptomatic Bacteriuria in South Western Nigerian Primary School Pupils

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Abstract: An epidemiological survey of the prevalence of symptomatic bacteriuria using Combi 9 test strips was undertaken among 894 primary school pupils aged 6-14 years at Imesi- Ile, rural community in Osun-State, South Western Nigeria, in order to identify those with renal disorders. Of the 288 symptomatic population, 2 were bacteriuric using Combi 9 test strips. When the samples from the same population were subjected to urine culture with colony counts, only 7 had significant bacteriuria on repeat culture. It was concluded that, even though the usage of the Combi 9 test strips is a fast screening method for bacteriuria and other biochemical tests, the yield for bacteriuria is low. It is therefore, suggested that the usage of the Combi 9 test strips for bacteriuria, should be combined with urine culture and colony counts for significant bacteriuria. Also, Urine that had stayed for a fairly long period in the bladder like the early morning urine will be the preferred sample.

Key words: Symptomatic, bacteriuria, school children

INTRODUCTION

Bacteriuria is the presence of bacteria in the urine (Simonetti and Konrad, 2006). This is not necessarily indicative of infection, since normal urine is commonly contaminated by the bacteria flora in the lower urethral meatus. Significant bacteriuria is the presence of 10^5 or more micro-organisms per millilitre of clean catch specimen of urine (Okafor *et al*., 1993; Stanley, 2007). A lower bacteria count of $>10^3$-$< 10^5$/mL is placed in a suspicious diagnostic group, deserving further investigation for possible urinary infection (Stanley, 2007; Qureshi, 2005; Behrman *et al*., 2000). It could be due to suppressed but active low grade infection.

In symptomatic bacteriuria, there may be symptoms like fever, frequency, dysuria, nausea, vomiting, rigors and chills (Qureshi, 2005; Behrman *et al*., 2000). Urinary tract infections, whether symptomatic or asymptomatic, are of greater significance in childhood than in adults, because most renal scars occur after such infections within the first 5 years of life. The urinary tract is usually infected by the ascending route, although sometimes in the newborn it may be part of a systemic (Behrman *et al*., 2000). Urinary tract infections rarely arise from other septic foci in older children. Urine is a good culture medium and anything contributing to stasis, or to accumulation of excessive urine, will encourage bacterial colonization and multiplication.Common bacteria pathogens causing urinary tract infections include, *Escerichia coli*, *Klebsiella*, sp. *Streptococcus faecalis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Proteus* sp. (Simonetti and Konrad, 2006; Stanley, 2007).

The development of fast screening methods for proteinuria, haematuria and bacteriuria, has improved the chances of early detection and management of renal diseases. One of such is the Medi-test Combi 9. The strip can determine many parameters in the urine viz:

- Blood.
- Urobilinogen.
- Bilirubin.
- Protein.
- Nitrite.
- Ketone.
- Ascorbic acid.
- Glucose.
- pH.

A previous study conducted over 2 decades ago in another Nigerian community has shown that the detection of protein, red blood cells or bacteria in the urine on screening may be indicative of a renal disorder in children (Bello, 1988). The prevalence and pattern of renal diseases among children in Imesi-Ile is however unknown. Thus this study was carried out to document the presence and types of renal disorders in this community.

Imesi-Ile community is a rural town located in the Obokun local government area. It is located on a hill with a population of about 10,000 people. The choice of

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Imesi-Ile was considered very appropriate for the investigators because it is a closed rural community with a fairly captive population where a number of studies had already been carried out in the past and where long-term follow-up and patient tracing is recognised to be feasible.

MATERIALS AND METHODS

The subjects were pupils aged between 6 and 14 years old, attending the 7 primary schools located at Imesi-Ile, in who due consent was obtained. Pupils on vitamin c or vitamin c containing drugs were excluded. Information was obtained from the pupils by the means of a questionnaire. The details obtained include, age, sex and history pertaining to symptoms and signs of renal diseases. A detailed physical examination was then conducted on each pupil to detect the presence of palor, oedema, dehydration, jaundice or fever. The weights and heights of all the pupils were also taken. Thereafter mid stream urine samples were obtained in a sterile universal bottle for individual pupils, under aseptic techniques. The urine samples obtained from each pupil were then tested using Combi 9 strips. Pupils with proteinuria were tested 2 more times for persistence. Also, samples obtained from pupils with features suggestive of urinary tract infection such as loin pain, frequency of micturition, dysuria and or turbid urine were subjected to urine culture and sensitivity. The urine samples cultured were inoculated on the Cysteine Lactose Electrolyte Deficient medium (CLED) using a sterile platinum wire loop. The plates were incubated for 24 h after which the colonies were counted. Colony count was obtained by multiplying the number of colonies on the plate by 100. Bacteria colony counts of 10^4/ml of urine and below were regarded as negative; those between 10^4 and 10^5/mL of urine were repeated, while those $>10^5$/mL of urine, of pure bacterial growth on 2 consecutive occasions were regarded as positive. The time interval between the first and the second investigation was 48-72 h. One colony from a pure culture of the test organism was inoculated into 5 mLs of nutrient broth and incubated at 37°C for 24 h. It was then poured on a nutrient agar and dried in an incubator. Discs impregnated with antibiotics were placed aseptically on the surface of the nutrient agar 3-4 cm apart from each other and they were incubated at 37°C overnight, after which the diameter of the zone of growth inhibition was measured. A zone of inhibition less than 15 mm was taken as resistant, while those above 15 mm were judged sensitive.

The results were analyzed with the Pearson chi-squared (χ^2) tests. p values <0.05 were considered statistically significant.

RESULTS AND DISCUSSION

Age and sex distribution of the population: The age and the sex distribution of the population under study are shown in Table 1.

There were 503 boys and 391 girls. Male: Female ratio was 1.2: 1. The mean age of the population studied was 9.32 years, median age was 10 years.

Combi 9 dipstick screening results: None of the pupils had glucose or bilirubin in their urine. Eleven pupils had urobilinogen in excessive amounts. Of these 11, four (36.36%) had ongoing malaria infection, while the other 7(63.63%) were sicklers. Ketones were found in the urine of 14 pupils and ascorbic acid in the urine of 12 pupils. Majority of the pupils had pH between 6.0 and 7.0. Proteinuria was detected in 69 pupils and the proteinuria detected was persistent in 34, while heamaturia was detected in 48. Nitrite positive results were obtained in 3 pupils. The results obtained from the Combi 9 dipstick screening results of the urine are shown in Table 2.

Urine microscopy and bacteruria screening: Urine microscopy and bacteriuria screening with colony counts were carried out in 288 children who either had various complaints suggestive of urinary tract infections (loin

Table 1: Age and sex distribution of the 894 Imesi-Ile primary school children screened for bacteriuria

Age at last Birthday	Number of Males	Number of Females	Total	(%)
6	49	42	91	10.18
7	54	36	90	10.07
8	66	54	120	13.42
9	62	35	97	10.85
10	103	63	166	18.57
11	36	41	77	8.62
12	73	69	142	15.88
13	37	34	71	7.94
14	23	17	40	4.47
Total	503	391	894	100.00

Table 2: Combi 9 positive dipstick screening results of the 894 pupil

Parameter	Number of males	Number of females	Total
Blood	28	20	48
Urobilinogen	8	3	11
Bilirubin	0	0	0
Protein (first screening)	48	21	69
Protein (third screening)	22	12	34
Nitrite	0	2	2
Ketone	9	5	14
Ascorbic acid	39	23	62
Glucose	0	0	0
pH- 9	37	21	58
- 8	42	29	71
- 7	183	144	327
- 6	259	172	431
- 5	2	5	7

pains in 17, dysuria 64, frequency 123) or those with positive dipstick results. Among those with positive urine dipsticks results, haematuria was found in 48, persistent proteinuria in 34 and 2 pupils had nitrite positive tests.

Screening of the urine for bacteria yielded positive culture results in 12(41.7%) of the 288 pupils with colony counts $>10^5$ colonies/mL with the first urine culture. On repeating the urine culture 48-72 h later, 7 were bacteruiric. This yield from colony count was higher than those from nitrite tests. The organisms cultured in the pupils with significant bacteriuria on the 2 occasions were: *Escherichia coli* in 3, *Klebsiella* sp. in 2, *Staphylococcus aureus* in 1 and *Proteus* sp. in another 1. Five (1.74%) were females while 2 (0.69%) were males. The results are shown in Table 3. The 2 pupils with positive nitrite tests were among the 5 females with significant bacteriuria on repeat culture. *Escherichia coli* were isolated from their urine samples.

One hundred and sixty four (56.94%) of the 288 pupils were males, while the remaining 124(43.06%) were females. Five (3.96%) of the 126 females screened proved positive for bacteriuria. The differences of the greater proportion of females who proved positive is statistically significant $\chi^2 = 9.54$, $p<0.05$, df = 4.

Sensitivity pattern of the organisms cultured: All the organisms cultured were sensitive to gentamicin, co-trimoxazole and nitrofurantoin. Thus, the affected pupils were treated with co-trimoxazole because it is cheap and easily administered. Follow up urine culture 1 week after treatment revealed no growth. The results of the urinary culture sensitivity pattern in the 7 pupils with bacteriuria at 72 h are shown in Table 4.

The dipstick has been used in some previous studies to screen for parameters like, protein, blood and bacteria in the urine (Bello, 1988; Onile *et al*., 1985). The prevalence of 2(0.22%) for nitrite positive results is less than the value of 52% obtained by Onile *et al*. (1985) who tested for pus cells with combur-9 (Boehringer Mannheim). The fact that the 2 nitrite dipstick positive results were confirmed by significant bacteriuria on the 2 successive occasions with growth of *Escherichia coli* suggests that the nitrite dipstick positive results are highly suggestive of infection of the urinary tract. Urine samples that stayed long in the bladder, such as the early morning urine are ideal for bacteriuria screening using nitrite test for Combi 9. The fact that these pupils were not resident at hostels or hospitals, made the collection of the overnight/early morning urine samples difficult. The nitrite test for bacteriuria screening test is specific for organisms that can convert nitrates to nitrites in the urine. This may explain why the yield with the test strip was low.

There was significant bacteriuria on repeat culture in 7(2.43%) of the 288 pupils screened. This however did not give an authentic result of the prevalence of bacteriuria in the entire population of the 894 pupils studied. This is because only those with symptoms referable to the urinary tract disease and those with proteinuria, heamaturia and a positive nitrite test were screened. Thus, it is not unlikely that pupils with asymptomatic bacteriuria may have been missed in the present study. The modality employed for choosing the pupils with bacteriuria in the present study was adopted because of limited resources. Our prevalence value of 2.43% for bacteriuria is less than the 6% obtained among children attending the infant welfare clinic at the Ibadan Institute of Health (Akinkugbe *et al*., 1973) and the prevalence figures of 38 and 5.8% obtained among paediatric out patient population of the Ife University teaching Hospital and the those recorded among patients with sickle cell anemia, respectively. (Elegbe, 1984; Ajasin and Adegbola, 1988) These differences in the prevalence figures may be attributed to differences in the methods of screening and

Table 3: Age and sex distribution of the 7 pupils with significant bacteriuria on repeat culture

Age	Number of males	Number of females	Total
	(% of 7)	(% of 7)	(% of 7)
10	0	3(42.86%)	3(42.86%)
11	0	1(14.285%)	1(14.285%)
12	1(14.285%)	0	1(14.285%)
13	0	1(14.285%)	1(14.285%)
14	1(14.285%)	0	1(14.285%)
Total	2 (28.57%)	5 (71.43%)	7(100.00%)

Table 4: Sensitivity pattern of the organisms cultured from the urine of the 7 pupils with bacteriuria

	Escherichia coli		*Klebsiella* sp.			*Proteus* sp.	Staphylococcus aureus
Pupils no	1	2	3	4	5	6	7
Ampicillin	S	S	R	R	R	S	R
Tetracycline	NT	NT	NT	S	NT	NT	NT
Gentamycin	S	S	S	S	S	S	S
Co-trimoxazole	S	S	S	S	S	S	S
Streptomycin	NT	NT	NT	S	S	S	S
Nalidixic acid	NT	NT	NT	S	S	R	R
Nitrofurantoin	S	S	S	S	S	S	S

Key: S = Sensitive, R = Resistant, NT = Not Tested

the age groups studied by the various researchers. Bacteriological culture results similar to our findings in the present study were obtained in almost all of the previous studies carried out within and outside Nigeria. Escherichia coli was the most common isolate in the present s tudy and the previously quoted studies (Okafor *et al*., 1993; Elegbe, 1984). All the organisms isolated in the present study were sensitive to the commonly used antibiotics. This is contrary to the finding in a hospital based study by Wemambu *et al.* (1983) in which the isolated organisms were resistant to the commonly used antibiotics such as Co-trimoxazole and Ampicillin (Wemambu and Obi, 1983).

All the children with significant bacteriuria in the present study were 10 years and above, thus making the possibility of developing renal scars remote. The formation of renal scars are rare after the age of 5 years (Simonetti and Konrad, 2006; Qureshi, 2005). The follow-up urine culture a week after treatment revealed no growth, thus implying that the pupils were well treated for the bacteriuria. Pupil with *Proteus* sp. infection should be followed up for a relatively long period. This is because *Proteus* sp. are known to be associated with chronic bacteriuria. In addition *Proteus* sp. can also render urine alkaline and provide a medium for the formation of ammonium-magnesium-phosphate stones because of the urease activity in them. The presence of renal stones could cause pain, haematuria, hydronephrosis, pyelonephritis and anuria (Stamm and Turck, 1991).

CONCLUSION

The screening of large populations such as in the present study is expensive using Combi 9, more so, the yield is low. The large amount of money spent on routine screening of these pupils may have been preferably used to procure basic reagents for basic urine investigation. Selective screening as it is done during research, or when investigating children at risk and or before school entry may be a preferable option.

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