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Urinary Screening for Detection of Asymptomatic Haematuria and Proteinuria in Children in Urban and Periurban Schools in Port Harcourt

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Summary

Ikimalo FE, Eke FU, Nkanginieme KEO, Ikimalo J. Urinary Screening for Detection of Asymptomatic Haematuria and Proteinuria in Children in Urban and Periurban Schools in Port Harcourt. *Nigerian Journal of Paediatrics* **2003; 30:1.** In order to determine the prevalence of asymptomatic haematuria and proteinuria, a survey was carried out among pupils of two primary schools; one located in the urban area and the other in the periurban area of Port Harcourt Local Government Area. The prevalence rate of significant asymptomatic proteinuria was one percent and that for haematuria was 0.6 percent. There was no significant difference in the prevalence rate of asymptomatic proteinuria or haematuria between children in the periurban school when compared to those in the urban school. Although the yield from mass urinary screening was low, majority of those detected to have significant urinary abnormalities had persistence of those abnormalities when followed up. Urinalysis should therefore be done routinely as part of the school health programme in primary schools and children found to have urinary abnormalities should undergo further evaluation and follow up over a long period

Keywords: Urinary screening, Asymptomatic haematuria, Asymptomatic Proteinuria.

Introduction

ASYMPTOMATIC haematuria and proteinuria may be indicative of various nephropathies such as acute glomerulonephritis or conditions that cause nephritic syndrome like quartan malaria and schistosomiasis, or IgA nephropathy.[1] A significant proportion of children with nephropathies end up with hypertension and renal failure.[2,3] Some children with asymptomatic urinary abnormalities also develop renal failure. Some studies have shown that children with asymptomatic haematuria and/or proteinuria detected by mass screening programmes developed milder glomerular abnormalities when compared to those presenting with macroscopic haematuria, hypertension or massive proteinuria.[2,4,5] Studies carried out among children in Rivers State show that there is a high prevalence of renal diseases and a correspondingly high mortality rate from chronic renal failure.[6,7] However, there is little or no information about urinary screening for asymptomatic haematuria and proteinuria among children in the state. This study was therefore aimed at determining the prevalence of significant asymptomatic urinary abnormalities (haematuria and proteinuria) among school children in Rivers State and find out if these abnormalities are persistent. This, it is hoped, would indicate what proportion is likely to

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contribute to the population of children with chronic renal failure.

Subjects and Methods

Port Harcourt Local Government Area has 88 officially registered primary schools; 25 are located in the urban area and 63 in the periurban area. Most of the schools in the urban area are fee-paying private schools, while majority of the periurban schools are non-fee paying public schools. Primary school children from two randomly selected urban and periurban schools in Port Harcourt Local Government Area of Rivers State formed the subjects for the study. All apparently healthy children with no history of urinary symptoms (i.e. dysuria, increased urinary frequency or urgency, or macroscopic haematuria), no facial or pedal oedema and no history of fever in the week preceding the study, were included in the study. Children were excluded if they had any urinary symptoms, facial and/or pedal oedema and if they were menstruating at the time of the study. One thousand and seventy four pupils were selected for the study. The minimum sample size of 497 was calculated using a prevalence rate of 5.25 percent obtained from a previous study[8] and allowing for a sampling error of one percent, with the formula:[9]

$$\text{Sample size} = p \times q/(SE)^2$$

where: p = Prevalence; $q = 100 - p$;

SE = Sampling error tolerated.

In each school, a minimum of 500 children was selected from all arms of the classes by systematic sampling from the class register using a sampling interval of two. The children were interviewed using a questionnaire that gave relevant demographic information as well as information about presence of urinary symptoms, facial and/or pedal oedema, menstruation and fever. A physical examination which included blood pressure measurement, height, weight and temperature was also carried out on each child. Those who met the inclusion criteria were given labeled clean universal containers (*Sterilin®*) to collect their early morning urine and bring back to school the following day. They were also given consent forms and letters explaining the nature and purpose of the study as well as instructions on how to collect their early morning urine, which they were instructed to give to their parents. Signed consent forms were returned along with the urine specimens the next day.

The following morning, each urine specimen was divided into two aliquots and a dip stick urinalysis was performed on one aliquot of urine using *Multistix 10SG* which is capable of testing for ten different parameters including protein, blood, specific gravity, pH, nitrites and leucocytes. The samples were tested within three hours of collection. Proteinuria of 1+ (30mg/dl) or more was accepted as significant while haematuria of trace and above was also recorded. The second aliquot of urine specimens that were positive for blood and/or protein were stored in a cooler box with ice packs and transported to the laboratory within 4-6 hours where they were subjected to microscopy.

All children with significant urinary abnormalities were invited with their parents for further investigations at the University of Port Harcourt Teaching Hospital. On the first follow up visit which was one week after the initial screening, a repeat dipstick urinalysis was done. Urinalysis and culture were performed on those samples that were again positive for blood and/or protein, while serum electroytes, urea and creatinine levels were also determined. Serum albumin and total protein were also estimated in those who had proteinuria. Those with significant proteinuria had a 24-hr urinary protein estimation done.

The qualitative data of proteinuria and haematuria (+, ++ etc) was analysed using Chi-square test, and Fisher's exact test when an expected cell value was less than 5. The quantitative data, eg protein in $mg/m^2/hr$ was analyzed using the Student's 't'-test. A p value of <0.05 was considered significant.

Results

Of the 1074 pupils enrolled for the study, urine collection was obtained from 1010 children (506 girls and 504 boys) whose ages ranged between six years and 17years. Five hundred and two (49.7 percent) of the children were from the urban school and 508 (50.3 percent) from the periurban. Proteinuria and/or haematuria was detected in 252 (24.9 percent) of the 1010 subjects.

Proteinuria

A total of 238 children (23.6 percent) had varying degrees of proteinuria from trace to 2+ (100mg/dl) with 228 (95 percent) having a trace of proteinuria. Significant proteinuria (30mg/dl or 1+ and above) was found in ten (six females and four males) of the 1010 subjects, giving a prevalence of asymptomatic proteinuria of one percent. The prevalence of asymptomatic proteinuria in boys (0.8 percent) was lower than in girls (1.2 percent) but this difference was not significant ($\chi^2 = 0.40$, df = 1, $p = 0.752$). Table I shows the prevalence of significant proteinuria in various age groups; it was highest among the age group, 6-8 yrs. Seven of the 502 children from the urban school had abnormal proteinuria, a 1.4 percent prevalence rate of asymptomatic proteinuria in the

Table I

Prevalence of Significant Proteiuria by Age Groups

Age (yrs)	*No with Proteinuria*	*No of Negatives*	*Total*	*Prevalence Per cent*
6-8	3	235	238	1.26
9-11	6	527	533	1.12
12-14	1	217	218	0.46
15-17	0	21	21	0.00
Total	10	1000	1010	1.00

urban school. Corresponding figures among children from the periurban school were three of 508, and 0.6 percent. These rates were not significantly different, and are summarized in Table II.

Follow-up for proteinuria

The ten children with significant proteinuria were invited with their parents for further investigations. Eight (six from the urban and two from the periurban school) honoured the invitation. All eight children retested positive for protein when a repeat dipstick urinalysis was performed on their early morning urine specimen when they came for the first follow up visit.

Table II

Prevalence of Significant Proteinuria by school location

	Total No of children	*No with significant proteiuria*	*No without proteiuria*	*Prevalence Per cent*
Urban	502	7	495	1.4
Periurban	508	3	505	0.6

Table III

Severity of Proteinuria in relation to location of the school

Degree of Proteinuria	*Urban*	*Periurban*	*Total*
Moderate to severe	5	1	6
Mild	1	1	2
Total	6	2	8

Five of the six children from the urban school had moderate (2+) to severe proteinuria(3+) while one had mild proteinuria. Similarly, one of the two children from the periurban school who came for follow up had mild proteinuria and the other had severe proteinuria. However, there was no significant relationship between severity of proteinuria and location of the school. These findings are summarized in Table III.

Five of the eight children with significant proteinuria had an increase in the range of proteinuria while three had the same value as the first urinalysis. None of the urine samples contained cell casts or crystals. They all had normal values of serum electrolytes, urea and creatinine, albumin and total protein as well as normal blood pressure. None of them had symptoms suggestive of urinary tract infection and their urine cultures were negative. Twenty-four hour urinary protein excretion was raised in six of the eight children, the values ranging between 15 and 19mg/m^2/hr. There was no significant difference in the mean 24-hour urinary protein of urban school children compared to the periurban group ($t = 0.71$, $df = 6$, $p>0.05$). The remaining two children, both males, one from the urban and the other from the periurban school, had normal 24-hour urinary protein and they both had mild proteinuria on both the screening urinalysis as well as the follow up urinalysis.

Haematuria

Fourteen (1.4 percent) children had varying degrees of haematuria ranging from trace to 3+ and there was an identical overall sex distribution. A red blood cell (rbc) count of 5 or more per high power field (or 2+ and 3+) was considered significant and this was found in six (four males, two females) of the 1010 subjects studied, thereby giving a prevalence of significant asymptomatic haematuria of 0.6 percent. The prevalence of significant haematuria in boys (0.8

Table IV

Prevalece of Significant Haematuria by Age Group

Age (yrs)	*No. with Haematuria*	*No. of Negatives*	*Total*	*Prevalence Percent*
6-8	1	237	238	0.42
9-11	1	532	533	0.19
12-14	3	215	218	1.38
15-17	1	20	21	4.76
Total	6	1004	1010	0.60

Table V

Prevalence of Significant Haematuria by School Location

	Total No. of Children	*No. with Significant Haematuria*	*Prevalence Per cent*
Urban	502	1	0.2
Periurban	508	5	1.0

$\chi^2 = 2.66$, Df = 1, Fisher's exact P = 0.217

percent) was higher than in girls (0.4 percent) but this was not statistically significant ($\chi^2 = 0.67$, df = 1, Fisher's exact p value = 0.451). Table IV shows the prevalence of significant haematuria according to age groups; it was highest among children aged 15 to 17 years. Five of the 508 children from the periurban school had abnormal haematuria, a prevalence rate of significant asymptomatic haematuria of one percent. Corresponding figures among children from the urban school were one of the 502, and 0.2 percent. These rates were not significantly different, and are summarized in Table V. There was no significant relationship between severity of haematuria and location of the school ($\chi^2 = 0.60$, df = 1, Fisher's exact p value = 1.000).

Follow up of haematuria

All the six children with significant haematuria on the first follow up visit were confirmed positive on repeat urine microscopy (≥5 rbc/hpf). No schistosoma ova were found in the urine of any of these cases. All the children with haematuria had normal values of serum electrolytes, urea and creatinine and blood pressure measurements. None of them had cellular casts or crystals on urine microscopy and all urine cultures were negative. All the children with significant haematuria and proteinuria were referred to the nephrology clinic of the teaching hospital for further evaluation and follow up.

Combined proteinuria and haematuria

No subject exhibited both significant proteinuria and haematuria, thus the prevalence of this abnormality was 0 percent.

Discussion

The prevalence of significant proteinuria of one percent obtained in this study is lower than 3.8 percent and 4.72 percent reported from some other parts of this country.[8,10] The higher prevalence rate obtained by Abdurrahman *et al*[10] could be due to the fact that they collected daytime mid-stream urine from primary school children and therefore some of their positive cases could have resulted from vigorous exercise. Furthermore, repeat urinalysis was not performed on subjects who were positive on first testing and therefore children with transient proteinuria could also have been included. The higher prevalence recorded by Oviasu[8] could be attributed to the fact the subjects in that study were mainly adolescents drawn from secondary schools, and were therefore most likely older than those in the present study. Other studies[11,12] have shown that there is a direct correlation between urinary abnormalities, especially proteinuria, and increasing age in both males and females. The prevalence rate of proteinuria obtained in this study compares favourably with 0.37 percent obtained by Murakami *et al*[11] in Japan. The lower prevalence in that study could be because

protein quantification was done using the sulphosalicyclic acid test to exclude false positive results by the 'dip and read' method. Repeat testing of urine did not appreciably alter the results of initial testing in this study. This could be because early morning urine was tested, thereby minimizing the possible effects of vigorous exercise or alkaline urine on proteinuria and/or haematuria.[13] The *Multistix 10SG* used for the urinalysis in this study is capable of detecting nitrite and leucocytes in urine. It was therefore possible to eliminate false positive results from infected urine.

In the present study, 37.5 percent of the eight children with proteinuria had nephritic range proteinuria though they were oedema free. Renal biopsies were however not done on any of the subjects to ascertain if they had abnormal renal histology. All children with significant urinary abnormalities had normal blood pressure measurement; this may suggest that renal hypertension is probably an uncommon early event in children with significant asymptomatic haematuria or proteinuria in this environment. The reason for the higher, though statistically insignificant, prevalence of asymptomatic proteinuria among urban children compared to the periurban children obtained in this study cannot be readily explained. However, the prevalence of asymptomatic proteinuria among teenagers in a purely urban survey[8] was 4.7 percent and it was higher than 3.4 percent that was obtained among similar age group in a purely rural survey.[12]

The prevalence rate of 0.6 percent for significant haematuria obtained in this study compares favourably with 0.55 percent obtained by Oviasu[8] in Nigeria and 0.54 percent obtained by Murakami *et al*[11] in Japan. It is however, lower than 4.1 percent reported from Finland by Vehaskari *et al*[14] who examined four urine specimens from each individual which was collected over two consecutive mornings and evenings. Such a protocol will tend to include children with intermittent haematuria, and this may have accounted for the high prevalence of haematuria found in that study. The Port Harcourt area is not known to be endemic for urinary schistosomiasis and no ova of *Schistosoma haematobium* was found in the urine specimen of any of the children in this study. This could partly account for the rather low prevalence rate for haematuria observed in the present study. Haematuria was more common in the periurban group compared to the urban group, though this was not statistically significant.

A diagnosis of renal disease obviously cannot be based solely on urine abnormalities detected in a screening study such as this. In a five-year prospective study carried out on children with various renal disorders in Rivers State, it was found that two percent of the children with renal disorders developed end stage renal failure.[7] This figure is close to the 1.6 percent prevalence rate of significant asymptomatic haematuria and proteinuria obtained in the present study. This suggests that children with significant urinary abnormalities should be followed up over a long period of time in order to find out if they would develop renal disorders which may likely result in end stage renal disease. Although the yield from routine large scale urinary screening is generally low, it still remains the most likely way of detecting early renal lesions.[8] This is reflected in the number of asymptomatic cases with significantly raised 24-hr urinary protein detected in this study. Furthermore, all those who tested positive on initial urinalysis retested positive on the first follow up visit. This suggests that the urinary abnormalities detected at the time of initial testing were significant.

In our environment, where we have a rather high prevalence of renal disease (2.5 children per year per million childhood population)[7] and a correspondingly high mortality from chronic renal failure (53.3 percent),[6] it will be cheaper to adopt measures aimed at identifying subjects in the early stages of their renal disease so that they can be treated promptly and followed up. We therefore recommend that urinalysis should be done routinely as part of the school health programme in primary schools at the beginning of each school year, in order to detect the few children with abnormalities in their urine. All children detected as having urinary abnormalities should be further evaluated, properly investigated and followed up over a long period of time so as to prevent the development of end stage renal disease.

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