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Urine Analysis as a Screening Tool in Early Detection of Renal Abnormalities in Asymptomatic School Children

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Abstract

Background: Early identification of kidney diseases in children and adolescents is an important initial step in prevention of chronic kidney diseases (CKD). The current study was undertaken to screen asymptomatic school children in Nellore, Andhra Pradesh, and to detect the prevalence of renal disorders using urine dipstick method and associated risk factors.

Method: Out of total 1,626 children, 883 (54.31%) were male children and remaining 743 (45.69%) were female students. During the first screening by urine dipstick method, 45 (2.77%) children were found to having urinary abnormalities which were further investigated by confirmatory complete urine analysis.

Results: Finally 37 were diagnosed having urinary abnormalities. The prevalence rate of isolated hematuria (IH) was 0.62%; isolated proteinuria (IP) was 0.18%; combined hematuria and proteinuria (CHP) was 0.18% and urinary tract infection (UTI) was 1.23%. Renal stone was the cause in 20% cases while post-infectious golmerulonephritis (PIGN) and IgA nephropathy (IgAN) were the causes of hematuria in 10% cases each. Out of three cases of CHP, two (66.67%) cases were due to PIGN and one was due to membranoproliferative glomerulonephritis (MPGN). Totally 26 cases were confirmed having UTI. Out of these 26 cases, gram-negative bacilli were detected in 11 (42.31%) cases and gram-positive were detected in five (19.23%) cases. The prevalence rate of renal abnormalities among 6 - 7 years, 8 - 9 years, 10 - 11 years and 12 - 13 years students was 2.07%, 2.43%, 2.19 and 2.41% respectively. Out of 889 urban students, 19 were having confirmed renal abnormalities which indicated that the prevalence of renal problem in asymptomatic urban student was 2.14%. Out of 737 rural students, 18 were having confirmed renal abnormalities which indicated that the prevalence of renal problem in asymptomatic rural student was 2.44%. Prevalence of hematuria in male was 0.23 and in female 1.08 and the difference was statistically significant ($P < 0.05$) which indicated hematuria more in female asymptomatic students compared to male asymptomatic students. Age wise prevalence of IP ranged from 0% in 6 - 7 years age group and 12 - 13 years age group to 0.44% in 10 - 11 years age group. Prevalence of UTIs in male was 0.57 and in female 2.02, and the difference was statistically significant ($P < 0.05$) indicating that the prevalence of UTIs was significantly more in female asymptomatic students compared to male asymptomatic students.

Conclusions: In conclusion, asymptomatic urinary abnormalities might be detected by urine screening program at school age. Further work-up should be offered to define the exact etiology of any abnormal finding.

Keywords: End stage renal disease; School age chilldrens; Complete urine examination

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Introduction

Urine analysis, a simple and inexpensive test, is the cornerstone in the evaluation of the kidney function. Serious renal diseases may present without symptoms. Proteinuria as well as hematuria may be the only early signs of renal disease (membranous nephropathy (MN), membranoproliferative glomerulonephritis (MPGN), post-infectious glomerulonephritis (PIGN), IgA nephropathy (IgAN) and others) [1]. Also, the presence of detectable nitrites in urine has been used to diagnose urinary tract infection (UTI). UTI is very common in children with severe consequences on the kidney function leading to chronic kidney disease (CKD) and hypertension if left untreated [2].

An abnormal urine test may be the earliest warning of a significant renal disease. Because of its simplicity, routine urine analysis is the best way in early detection of most frequent conditions like proteinuria, hematuria or glycosuria at a very low cost. This is useful in selecting asymptomatic patients with renal diseases who may benefit from early treatment, counseling or who require long term follow-up [3].

The basic dipstick method is the most rapid screening procedure that could be helpful in the early detection of renal or urinary tract diseases among apparently healthy or asymptomatic subjects in the hope of preventing and retarding progression to chronic renal failure [4].

Worldwide, screening for CKD is controversial. The primary basis for this controversy is the uncertainty whether early detection of renal disorders in childhood will lead to effective interventions and reduction in the number of individuals who develop end stage renal disease (ESRD) [5]. There appears to

be a clear consensus among Japanese, Taiwanese, and Korean investigators that the screening programs currently in place in these countries have led to early detection and effective intervention. This opinion is not shared by investigators from North America and Europe, but their estimates of the prevalence of CKD in children predate the emergence of obesity and childhood hypertension. This may well have led to an underestimation of the prevalence of CKD in children [6].

Epidemiological data on the incidence and prevalence of CKD in the pediatric population is currently limited, imprecise, and flawed by methodological differences between various data resources. The incidence of ESRD in children ranges from 5 to 6 per million children under the age of 15 years in Europe, Australia, and Japan, to 10 to 11 per million children in the United States of America [7]. There is no data available regarding pediatric kidney disease incidence in India [8].

There are considerable differences in the pattern of renal disease around the world which arise from racial variation in the susceptibility to renal disease compounded with socioeconomic factors [9]. Congenital causes are responsible for the greatest percentage of cases of CKD seen in children. Although this is the most common reported etiology from developed countries where CKD is diagnosed in its early stages, infectious or acquired causes predominate in developing countries, where patients are referred in the later stages of kidney disease [10].

The simplest and least expensive way of screening the apparently healthy subject is urinalysis. Several studies have been made using reagent strips documenting their effectiveness in detecting urinary abnormalities at a relatively low cost. Mass screening helps to design population-oriented preventive measures that will limit the need for dialysis and transplantation. Prevention is more important in our setting given the shortage of financial resources and the fact that dialysis centers, equipment, and trained personnel are simply not available to the general population.

With this background, the present study was aimed to detect the prevalence of renal disorders and risk factors related to them, with spotting light on the role of school population-based urine screening in the early detection and prevention of progressive renal diseases in children in Nellore, Andhra Pradesh.

Materials and Methods

A cross sectional observational study was conducted in schools of rural and urban Nellore district of Andhra Pradesh, India. The duration of the study was 2 years. Totally 1,626 school student from rural and urban area of Nellore were enrolled. Multistage random sampling method was adopted for selection of schools. From the list of all schools of urban and rural area of Nellore, two schools from urban area and two schools from rural area were selected by simple random sampling technique using random number table.

Inclusion criteria

Children are considered eligible for entry into the study, if they met the following criteria: 1) age between 6 - 13 years, 2) residing at Nellore, 3) apparently healthy and 4) studying in the schools selected for the study.

Exclusion criteria

Children with pre-existing renal or any other systemic diseases, children on steroid therapy and children whose parents refused to give consent were excluded. Children absent on the date of survey were also excluded from the study.

Screening tool

The screening tool included a questionnaire documenting demographic and historical data together with on site measurements of urine dipstick for detection of protein, red blood cells (RBCs), and urinary tract infections.

Urine dipstick test

The urine sample was obtained from each child in a clean 50 mL vessel, which was tested with a urinary dipstick (Cybow) for urinary abnormalities as the first screening test.

Other confirmatory test

Children with abnormal urinary findings in the screening were subjected to detailed urine analysis.

Microscopic urine analysis

Urine was centrifuged and sediment was taken, the number of leucocytes and bacteria per high power field were recorded, RBCs count, then RBC morphology was examined for positive cases of hematuria. A RBC count of five or more per high power field was considered as hematuria.

Any abnormalities were further evaluated as necessary at the Department of Nephrology, Narayana Medical College, Nellore. A detailed history was taken, and physical and systemic examinations were performed on all children with urine abnormalities in the first screening. Final diagnosis was obtained for all cases.

The statistical analysis was performed using SPSS version 16.0. Chi-squared and Student's *t*-tests were applied to compare proportions and mean differences, respectively. A P value of less than 0.05 was considered significant.

Results

The present study was conducted among 1,626 children to detect the prevalence of renal disorders and risk factors related to them. Out of total 1,626 children, 883 (54.31%) were male

Table 1. Urinary Abnormalities Found in Children (n = 1,626)

Urinary abnormalities	First screening (by dipstick method)		Confirmatory screening (by complete urine analysis)	
	Cases	Percentage	Cases	Percentage
Isolated hematuria	14	0.86	10	0.62
Isolated proteinuria	5	0.31	3	0.18
Combined hematuria and proteinuria	3	0.18	3	0.18
Urinary tract infection	22	1.35	20	1.23
Other abnormalities	1	0.06	1	0.06
Total	45	2.77	37	2.28

children and remaining 743 (45.69%) were female students. The male to female ratio was 1.19. The distribution of study participants was according to their area. Out of total 1,626 children, 889 (54.67%) were from urban area and remaining 737 (45.33%) were from rural area.

As mentioned in the Table 1, during the first screening by urine dipstick method, 45 (2.77%) children were found to having urinary abnormalities which were further investigated by confirmatory complete urine analysis. Finally 37were diagnosed having urinary abnormalities. So the prevalence rate of renal abnormalities in asymptomatic children was found to be 2.28% in the present study. The prevalence rate of isolated hematuria (IH) was 0.62%; isolated proteinuria (IP) was 0.18%; combined hematuria and proteinuria (CHP) was 0.18% and UTI was 1.23%. Out of 10 confirmed cases of hematuria, 60% were diagnosed to be due to UTI. Renal stone was the cause in 20% cases while PIGN and IgAN were the causes of hematuria in 10% cases each. Out of three confirmed cases of proteinuria, two cases (66.66%) were diagnosed to be due to nephrotic syndrome and one was due to orthostatic proteinuria. Out of three cases of CHP, two (66.67%) cases were due to PIGN and one was due to MPGN. Total 26 cases were confirmed having UTI. Out of these 26 cases, gram-negative bacilli were detected in 11 (42.31%) cases and gram-positive were detected in 5 (19.23%) cases. In two cases mixed growth was isolated. In remaining eight (30.77%) cases bacterial count < 10^5 was found.

Biopsy was done in all three confirmed cases of CHP. Among the three cases biopsied two were found to have PIGN and one was MPGN.

Out of 10 confirmed IH cases biopsy was done in two cases. One of the cases had persistent hematuria for more than 6 months and the other had mild renal dysfunction at confirmation of hematuria. The former case was found to have IgA nephropathy and the other was PIGN. As mentioned in the table, out of 883 male students, 13 were having confirmed renal abnormalities indicating that the prevalence of renal problem in asymptomatic male student was 1.47%. Out of 743 female students, 24 were having confirmed renal abnormalities indicating that the prevalence of renal problem in asymptomatic female student was 3.23%.

Out of 889 urban students, 19 were having confirmed renal abnormalities indicating that the prevalence of renal problem in asymptomatic urban student was 2.14%. Out of 737 rural students, 18 were having confirmed renal abnormalities indicating that the prevalence of renal problem in asymptomatic rural student was 2.44%.

Table 2 indicates the prevalence of hematuria according to sex, age and area of asymptomatic students. Prevalence of hematuria in male was 0.23, 1.08 in female, and the difference was statistically significant ($P < 0.05$) indicating that the prevalence of hematuria was significantly more in female asymptomatic students compared to male asymptomatic students.

Age wise prevalence of hematuria ranged from 0.52% in 6 - 7 years age group to 0.73% in 8 - 9 years age group. The difference was not statistically significant ($P > 0.05$) indicating that the prevalence of hematuria was not associated with age of the students. Prevalence of hematuria in urban students was 0.67 and in rural students was 0.54, and the difference was not statistically significant ($P > 0.05$) indicating that the prevalence of hematuria was not associated with area of residence of the students.

Table 3 indicates prevalence of IP according to sex, age and area of asymptomatic students. Prevalence of IP in male was 0.23 and 0.13 in female, and the difference was not statistically significant ($P > 0.05$) indicating that the prevalence

Table 2. : Prevalence of Isolated Hematuria According to Demographic Variables (n = 1,626)

Demography variables	Hematuria cases	Percentage	P value
Sex			
Male	2	0.23	0.028*
Female	8	1.08	
Total	10	0.62	
Age			
6 - 7 years	2	0.52	0.977
8 - 9 years	3	0.73	
10 - 11 years	3	0.66	
12 - 13 years	2	0.54	
Total	10	0.62	
Area			
Urban	6	0.67	0.734
Rural	4	0.54	
Total	10	0.62	

*Statistically significant.

Table 3. Prevalence of Isolated Proteinuria According to Demographic Variables (n = 1,626)

Demography variables	Proteinuria cases	Percentage	P value
Sex			
Male	2	0.23	0.667
Female	1	0.13	
Total	3	0.18	
Age			
6 - 7 years	0	0.00	0.379
8 - 9 years	1	0.24	
10 - 11 years	2	0.44	
12 - 13 years	0	0.00	
Total	3	0.18	
Area			
Urban	2	0.22	0.676
Rural	1	0.14	
Total	3	0.18	

of IP was not associated with sex of the students. Age wise prevalence of IP ranged from 0% in 6 - 7 years age group and 12 - 13 years age group to 0.44% in 10 - 11 years age group. The difference was not statistically significant ($P > 0.05$) indicating that the prevalence of IP was not associated with age of the students.

Prevalence of IP in urban students was 0.22 and in rural students was 0.14, and the difference was not statistically significant ($P > 0.05$) indicating that the prevalence of IP was not associated with area of residence of the students.

Table 4 indicates prevalence of UTIs according to sex, age and area of asymptomatic students. Prevalence of UTIs in male was 0.57 and in female 2.02 and the difference was statistically significant ($P < 0.05$) indicating that the prevalence of UTIs was significantly more in female asymptomatic students compare to male asymptomatic students.

Age wise prevalence of UTIs ranged from 0.26% in 6 - 7 years age group to 1.75% in 10 - 11 years age group. The difference was not statistically significant ($P > 0.05$) indicating that the prevalence of UTIs was not associated with age of the students.

Prevalence of UTIs in urban students was 1.01 and in rural students was 1.49, and the difference was not statistically significant ($P > 0.05$) indicating that the prevalence of UTIs was not associated with area of residence of the students.

Discussion

Urine testing is an essential component of medical examination, and the basic dipstick method is the most common screening procedure for the early detection of renal or urinary tract diseases in apparently healthy or asymptomatic subjects [11]. Renal diseases are increasingly common causes of childhood morbidity and mortality [12]. Some of these diseases, if undetected and not treated early, may lead to debilitating chronic disease.

The present study was conducted among 1,626 children to detect the prevalence of renal disorders initially by using dipstick method and later confirmation by complete urine analysis among asymptomatic school students. The study also aimed to find out certain risk factors associated with the renal abnormalities.

During the first screening by urine dipstick method, 45 (2.77%) children were found to having urinary abnormalities which were further investigated by confirmatory complete urine analysis. Finally 37 were diagnosed having urinary ab-

Table 4. : Prevalence of UTIs According to Demographic Variables (n = 1,626)

Demographic variables	Urinary tract infection cases	Percentage	P valve
Sex			
Male	5	0.57	0.008*
Female	15	2.02	
Total	20	1.23	
Age			
6 - 7 years	1	0.26	0.236
8 - 9 years	6	1.46	
10 - 11 years	8	1.75	
12 - 13 years	5	1.34	
Total	20	1.23	
Area			
Urban	9	1.01	0.381
Rural	11	1.49	
Total	20	1.23	

*Statistically significant.

normalities. So the prevalence rate of renal abnormalities in asymptomatic children was found to be 2.28% in the present study. This data revealed eight cases as false positive. The prevalence rate of IH was 0.62%; IP 0.18%; CHP 0.18% and UTI 1.23%.

In a study by Parekh et al [13], in the first screening, 5.5% of the children were found to be test-positive, and on further testing in the second screening, 0.71% children were found to be test-positive. Repeat screenings were performed to eliminate false positives. The author reported false positivity may be due to exercise, exposure to cold, prolonged recumbence, and contamination of urine samples with menstrual blood in females [14].

Bakr et al [15] reported urinary abnormalities in 1.3% of Egyptian school children in their first screening and it persisted in 0.72% in their second screening. Plata et al [16] screened 14,082 Bolivian subjects (80% of them under the age of 15 years) and reported that urine abnormalities were detected in 4,261 (30.3%) at the first screening and in only 1,019 (7.2%) subjects at the second screening.

Out of 10 confirmed cases of hematuria, 60% were diagnosed to be due to UTI. Renal stone was the cause in 20% of the cases while PIGN and IgAN were the causes of hematuria in 10% cases each. Out of three confirmed cases of proteinuria, two (66.66%) were diagnosed to be due to nephrotic syndrome and one was due to orthostatic proteinuria. Out of three cases of CHP, two (66.67%) cases were due to PIGN and one was due to MPGN. Total 26 cases were confirmed having UTI. Out of these 26 cases, gram-negative bacilli were detected in 11 (42.31%) cases and gram-positive were detected in five (19.23%) cases. In two cases mixed growth was isolated. In remaining eight (30.77%) cases bacterial count $< 10^5$ was found.

Overall IH was more common (0.40%) than IP (0.22%) and CHP (0.09%). In some studies IH was more common than IP [15], while in others the reverse was found [17, 18]. Further, it was observed that those children who were already screened and sent to the hospital had a much higher incidence of IH (46.4% - 60.1%), IP (4.9% - 26.4%), and CHP (13.5% - 17.5%) [19, 20].

Five children (50%) had features of glomerulonephritis in a study by Parekh et al [13]. Murakami et al [21] from Japan and Bakr et al [15] from Egypt reported glomerulonephritis in 76.6% and 66.6% of their children with confirmed urinary abnormalities, respectively. Four cases had features of lupus nephritis with positive serology and one had acute post-streptococcal glomerulonephritis, which subsequently resolved. Lin et al [22] from Taiwan also reported that the most common etiology was lupus nephritis (31.6%) in their children. However, Park et al [19] from Korea found IgA nephropathy and Cho et al [20] found mesangioproliferative glomerulonephritis (21.9%) and IgA nephropathy (11.3%) as predominant etiologies. However, Bergstein et al [23] reported that no cause was discovered in 274 out of 342 children with microscopic hematuria and the most common cause of the disease was hypercalciuria (16%) in their series. Similarly, Chander et al [24] found that 52.1% of children who were found to have silent abnormal urinalysis had no definite diagnosis, but organic kidney diseases and hypercalciuria accounted for 14.9% and 14.4%, respectively.

The finding of hematuria and proteinuria in the present study is instructive as it may suggest the presence of underlying renal disease in these subjects. Renal diseases such as nephritis are common in developing countries, where survey screening has shown a high prevalence for proteinuria with or without hematuria [25]. The simultaneous occurrence of these two abnormalities has been shown to be a significant predictor of ESRD [20].

The higher prevalence in this study cannot be readily explained since bilirubin is normally not detected in urine while there may be a trace of urobilinogen in the urine [26]. However, environmental factors may play a role. Urobilinogenuria is also an indicator of increased hemolysis or conjugated hyperbilirubinemia.

Out of 883 male students, 13 cases were having confirmed renal abnormalities indicating that the prevalence of renal problem in asymptomatic male student was 1.47%. Out of 743 female students, 24 were having confirmed renal abnormalities indicating that the prevalence of renal problem in asymptomatic female student was 3.23%. Application of Chi-square indicates that the urinary abnormalities were significantly higher among female students compare to male students ($P < 0.05$).

Bakr A et al [15] in their study found that gender, age or socioeconomic status had no impact on the prevalence of urinary abnormalities. Among the affected children, the male to female ratio was 0.71:1. Au-Vehaskari et al [27] found that the prevalence of urinary abnormalities was not age or sex dependent. Park et al [19] reported a male to female ratio of 0.94:1 in Korean children but a ratio of 1.08:1 in Taiwan children [22]. Oviasu [28] showed that microscopic urinary abnormalities were more common in girls than in boys in Nigeria.

Evaluation of children with persistent urinary abnormalities showed that glomerulonephritis (GN) was the most common responsible underlying cause in the study by Bakr A et al [15]. Of the 12 children with persistent urinary changes, eight (66.7%) had evidence of GN. Hypercalciuria, renal stone and orthostatic proteinuria were the other underlying causes. No obvious cause was identified in one child who had no family history of hematuria or electron microscopic examination.

Poststreptococcal acute glomerulonephritis (PSAGN) was the most common form of GN encountered in a study by Bakr A et al [15] (5/8; 62.5%). Three children had focal segmental glomerulosclerosis (FSGS), diffuse mesangial proliferation (DMP) and IgAN. Systemic lupus erytheromatosis is the most common cause of GN as shown by a mass urine screening for primary school children [22]. On the other hand, IgAN is the leading cause in Japan [29] and Korea [19]. PSAGN is prevalent in Egypt as β-hemolytic streptococci are still endemic.

Renal biopsy was performed in four children in the study by Bakr A et al [15] (two with CHP, one with IP and one with IH). No abnormality was detected in the children with IH but FSGS, DMP and IgAN in the others. Asymptomatic hematuria is recognized as a common problem in children and adolescents and it is likely to have a favorable prognosis [7]. The most common causes of persistent non-orthostatic, non-nephrotic pathological proteinuria in children include FSGS, IgAN and membranoproliferative GN [30].

The prevalence rate of renal abnormalities among 6 - 7 years students, 8 - 9 years students, 10 - 11 years students and

12 - 13 years students was 2.07%, 2.43%, 2.19 and 2.41% respectively.

Out of 889 urban students, 19 were having confirmed renal abnormalities indicating that the prevalence of renal problem in asymptomatic urban student was 2.14%. Out of 737 rural students, 18 were having confirmed renal abnormalities indicating that the prevalence of renal problem in asymptomatic rural student was 2.44%.

Prevalence of hematuria in male was 0.23 and in female 1.08, and the difference was statistically significant ($P < 0.05$) indicating that the prevalence of hematuria was significantly more in female asymptomatic students compared to male asymptomatic students. Age wise prevalence of hematuria ranged from 0.52% in 6 - 7 years age group to 0.73% in 8 - 9 years age group.

Hematuria was the more common abnormality than proteinuria in our studied group. This was contrasted to other studies as in Egypt and Nigeria where proteinuria was the most common positive finding [15]. The development of asymptomatic microscopic hematuria is relatively common in children. Its prevalence in school aged children has been estimated at 0.5% to 2.0% depending on the population screened. This was comparable to our results that showed a prevalence of 1.5% at the second screening (1.0% for IH; 0.45% for CHN).

A careful family history is critical in the initial assessment of the child with hematuria in view of numerous genetic causes of renal disorders. Hereditary glomerular diseases include hereditary nephritis (Alport syndrome), thin glomerular basement membrane disease, SLE nephritis, and IgA nephropathy (Berger disease). Other hematuric renal disorders with a hereditary component include polycystic kidney disease (PKD) (both autosomal recessive (ARPKD) and autosomal dominant (ADPKD)), urolithiasis, and sickle cell disease/trait.

Children with persistent asymptomatic IH and a normal evaluation should have their blood pressure and urine checked every 3 months until the hematuria resolves. Referral to a pediatric nephrologist should be considered for patients with persistent asymptomatic hematuria greater than 1 year's duration and is recommended for patients with nephritis (glomerulonephritis, tubulointerstitial nephritis), hypertension, renal insufficiency, urolithiasis or nephrocalcinosis, or a family history of renal disease such as PKD or hereditary nephritis. Renal biopsy is indicated for some children with persistent microscopic hematuria and most children with recurrent gross hematuria associated with decreased renal function, proteinuria, or hypertension.

The clinical significance of asymptomatic hematuria remains unclear and the merit of such an evaluation has not been confirmed. The child with persistent asymptomatic isolated microscopic hematuria of longer than 2 week duration poses a dilemma in regard to the degree of further diagnostic testing that should be performed. Based on medical recommendations, a child with persistent microscopic hematuria should be followed closely every 3 months and for 1 year [31].

Studies showed that microscopic asymptomatic hematuria might be benign but it can also be an important sign of underlying disease. However, limitations of these studies were the absence of long term follow-up and thus, the frequency of development of complications and occult kidney disease was not known. Furthermore, it seems that in patients with microscopic hematuria due to occult glomerular disorders, progression to clinically significant disease will be accompanied by the development of hypertension with or without proteinuria or gross hematuria. Thus, long term follow-up in children with microscopic hematuria is mandatory [23].

The demonstration of proteinuria on a routine screening urinalysis is common; 10% of children aged 8 - 15 years test positive for proteinuria by urinary dipstick at some time. The challenge is to differentiate the child with proteinuria related to renal disease from the otherwise healthy child with transient or other benign forms of proteinuria.

In this study, the proportion of students with IP was 0.18% at the second screening. In Northern Iran and Nigeria, they reported that the prevalence of proteinuria was 1.6% and 3.5% respectively [18]. These reports were higher than those of Tokyo and Egypt with the prevalence 0.08% and 0.12% respectively [15, 18].

Most UTIs are ascending infections. The bacteria arise from the fecal flora, colonize the perineum, and enter the bladder via the urethra. In uncircumcised boys, the bacterial pathogens arise from the flora beneath the prepuce. In some cases, the bacteria causing cystitis ascend to the kidney to cause pyelonephritis.

In the present study prevalence of UTIs in male was 0.57 and in female 2.02 and the difference was statistically significant ($P < 0.05$) indicating that the prevalence of UTIs was significantly more in female asymptomatic students compared to male asymptomatic students. Age wise prevalence of UTIs ranged from 0.26% in 6 - 7 years age group to 1.75% in 10 - 11 years age group. The difference was not statistically significant ($P > 0.05$) indicating that the prevalence of UTIs was not associated with age of the students. Prevalence of UTIs in urban students was 1.01 and in rural students was 1.49 and the difference was not statistically significant ($P > 0.05$) indicating that the prevalence of UTIs was not associated with area of residence of the students.

Though the detailed pathogenic investigation was not the part of the study, it is important to discuss it at this point. The pathogenesis of UTI is based in part on the presence of bacterial pili or fimbriae on the bacterial surface. There are two types of fimbriae, type I and type II. Type I fimbriae are found on most strains of *E. coli.* Because attachment to target cells can be blocked by D-mannose, these fimbriae are referred to as mannose-sensitive. They have no role in pyelonephritis. The attachment of type II fimbriae is not inhibited by mannose, and these are known as mannose-resistant. These fimbriae are expressed by only certain strains of *E. coli.* The receptor for type II fimbriae is a glycosphingolipid that is present on both the uroepithelial cell membrane and RBCs. The Gal 1-4 Gal oligosaccharide fraction is the specific receptor. Because these fimbriae can agglutinate by P blood group erythrocytes, they are known as P fimbriae. Bacteria with P fimbriae are more likely to cause pyelonephritis. Between 76-94% of pyelonephritogenic strains of *E. coli* have P fimbriae, compared with 19-23% of cystitis strains.

From the above statement, it is evident that there is difference in data between Asia and United States. India is one of the developing countries of Asia with poor socioeconomic

status and poor education in its periphery where routine visits to pediatricians are infrequent. This reinforces the necessity of screening children at school entry by dipstick urine analysis.

Conclusions

The prevalence of urinal abnormalities during the first screening by urine dipstick method was found to be 2.77% among school going asymptomatic children. Those who were found to having urinary abnormalities were further investigated by confirmatory complete urine analysis. After confirmatory investigations the final prevalence was 2.28% in the present study. The prevalence rate of IH was 0.62%; IP was 0.18%; CHP was 0.18%, and UTI was 1.23%. Urinary abnormalities including IH and UTIs were significantly higher among female students compared to male students. The urinary abnormalities including IH, IP and UTIs were not associated with age of the student and area of study. This study also concludes that the urine dipstick is a simple, feasible and cost effective technique for early identification of urinary abnormalities in asymptomatic school children.

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