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Original Research Article

Dipstick urine analysis for detection of renal abnormalities among school children

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ABSTRACT

Background: Urine analysis by dipstick is a useful tool to identify children with asymptomatic renal diseases. Dipstick urinalysis screening was conducted in asymptomatic school children to detect prevalence of renal disease.
Methods: A cross sectional study was carried out in 862 children of age 6 to 15 years studying in different schools of Birgunj, Nepal between January 2019 to June 2019. First morning mid-stream urine samples were obtained from students and tested by dipstick method. Children with abnormal findings were re-tested after fifteen days.
Results: Ninety-six (11.13%) children had urinary abnormalities at the first screening; 8 children had specific urinary abnormalities after second screening. 4 children had urinary tract infection, followed by glomerulonephritis, type 1 diabetes, hydronephrosis and nephrotic syndrome. Urinary abnormalities were more common in females than in males.
Conclusions: Asymptomatic urinary abnormalities are detected by urine screening program at school age. Further work-up reveals the specific diagnosis and effective interventions help reduce the renal disease in future.

Keywords: Dipstick urine analysis, Proteinuria, Renal disease, School children

INTRODUCTION

Urinary screening program to diagnose asymptomatic renal disease in school going children is widespread in the developed countries.[1] Early identification and treatment of kidney diseases in children are important initial steps in prevention of chronic kidney diseases (CKD). CKD in children is a worldwide health problem and may be too covert for early detection.[2] The simplest and least expensive method of screening apparently healthy individuals is dipstick urine analysis.[3,4] Several studies have used reagent strips and have documented their effectiveness in detecting urinary abnormalities.[5,6] School urinary dipstick screening allows early detection of the disease and helps prevents the onset of renal insufficiency. Proteinuria in children may be early marker of kidney disease in children. Similarly, glycosuria is seen in patients with urinary diseases or DM. There is wide variation in the incidence and pattern of renal diseases in Asia.[7-10] Few studies have been done in Nepal and none from this region. Hence, this study was prospectively conducted as a urinary screening for asymptomatic school children.

METHODS

This study was performed from January 2019 to June 2019. A total of 862 children aged 6-15 years from 2 different schools of Birgunj, Nepal were included in the study. Assuming that the prevalence of urinary abnormalities in 6-15-year old is 5.5%, and given the population of 20,000 in this age group in Birgunj and 80% as the power of study, the necessary sample size was determined to be 819.[11] Children with pre-existing renal or any other systemic diseases, children on steroid therapy, and children whose parents refused to give consent were excluded. The protocol of the study was approved by the Institute Ethics Committee and informed

written consent was obtained from parents and the school administration. The first morning urine sample was obtained from each child in a clean 10 mL vessel, which was tested with a urinary dipstick (Insight Urinalysis Reagent Strips, Acon Laboratories, San Diego, CA, USA) for proteinuria and/or glycosuria as a first screening test. The second screening test was performed 2 weeks later by urinary dipstick on children who had tested positive in the first screening. Children with abnormal urinary findings in the second screening were tested for urinary microscopic, urine culture, 24-hour urinary protein, and spot urinary calcium/creatinine ratio. A detailed history was taken, and physical and systemic examinations were performed on all children with urine abnormalities in the second screening. Anthropometric parameters such as weight, height, and blood pressure were recorded.

Inclusion criteria

- All children from age 6 to 15 years enrolled in study school.

Exclusion criteria

- Children with known renal disease and other systemic disease
- Children on chronic steroid therapy
- Children/Guardian who denied consent.

All individuals above the age of 18 years were included in to the study. Informed consent was taken prior to conduct of the study.

RESULTS

Consent forms were given to 945 asymptomatic school children aged 6-15 years, 862 completed forms were returned. Thus, the first dipstick screening urine analysis was performed on 862 children, 520 were males (60.3%) and 344 were females (39.7%). In the first screening, 96 children (11.13%) were found to test positive for proteinuria. Basic parameters such as age, gender, systolic and diastolic blood pressure, weight, height was analysed. There was no significant difference between these parameters in children with or without urinary problems.

The frequency of positive children in first screening is presented in Table 1. 96 children tested positive for Proteinuria; 90 children had trace protein while 6 children had 1+ proteinuria. Calcium oxalate crystals were seen in 17 children. All children who tested positive in first screening underwent further evaluation with microscopy.

Table 1: Results following 1st urine analysis.

	Male	Female	Total
Proteinuria trace	29	35	64
Proteinuria 1+	1	4	5
Proteinuria trace and glycosuria	1	0	1
Proteinuria 1+ and glycosuria	1	0	1
Proteinuria trace and uric acid crystals	1	1	2
Proteinuria trace and bacteuria	0	1	1
Proteinuria trace and leukocyturia >5/HPF	2	2	4
Proteinuria trace and gross haematuria	0	1	1
Proteinuria trace and calcium oxalate	10	7	17

Table 2: Gender wise results after 2nd screening.

	Male	Female	Total
Proteinuria 2+	1	0	1
Proteinuria 1+	1	3	4
Proteinuria 1+ and glycosuria	1	0	1
Proteinuria 1+ and bacteuria	0	1	1
Proteinuria 1+ and leucocyturia >5/HPF	1	2	3

A total 96 children underwent urine microscopic and repeat urinalysis by dipstick. The frequency of positive children in second screening is presented in Table 2. All children with screening positivity in 2nd screening underwent specific investigations and are presented in Table 3. Children who had proteinuria and/or glycosuria during 1st screening underwent microscopy, 10 children underwent further analysis. 2 children were found to be normal and 8 had specific diagnosis. Children were evaluated with urine culture, Ultrasonography KUB, ASO titre etc., for specific diagnosis.

Table 3: Patients with final diagnosis after 2nd screening.

Case	Age/gender	Findings	Comments
Patient 1	14 year/M	HbA1c: 6.8 antibody positivity IAA diabetes	Type 1 diabetes
Patient 2	5 year/M	UTI	Urine culture positive
Patient 3	13 year/F	UTI	Urine culture positive
Patient 4	11 year/F	UTI	Urine culture positive
Patient 5	9 year/F	UTI	Urine culture positive
Patient 6	7 year/M	Nephrotic syndrome	Nephrotic Syndrome
Patient 7	7 year/F	PSGN	PSGN
Patient 8	6 year/M	Hydronephrosis	Hydronephrosis

DISCUSSION

Urinary screening by dipstick is regarded as one of the best and effective method for early detection of renal disease in asymptomatic children.[12]

Authors looked for proteinuria in school children of age 5 to 15 years. 11.1% of the children were found to have positive urinalysis i.e. proteinuria during first screening. Children having positive urinalysis during first screening underwent further screening after 2 weeks, and specific investigations were done for those having positive screening results. 8 children were found to have specific disease i.e., 0.93% in the screened children.

School children were screened with dipstick urine analysis in many countries. Some studies showed higher prevalence of asymptomatic urinary abnormalities, while some had very low prevalence. A study from Qatar by Al-Kaabi A done in 3645 apparently healthy primary school children found 11.9% had persistent urinary abnormality after 3rd dipstick analysis.[13] Similarly, another study from Egypt done by Fouad et al, in 12-15 years adolescent children showed the prevalence of asymptomatic urinary abnormalities in 32.1% during first screening, and these abnormalities persisted in 13.8% in the second screening.[10] Study from India by Srinivasulu K et al, from Andhra Pradesh found 2.77% of children had urinary abnormality.[14] Another study from Egypt, showed lower prevalence (1.3%) of urinary abnormalities in school children. Similarly, a lower prevalence of urinary abnormalities (3.56%) was reported in elementary school children in Japan.[16] Shajari et al, found that 4.7% of children tested positive in their first screening and 1.4% in their second screening.[12] In a study from Dharan Nepal, 5.5% of the children were test-positive in first screening, and on further testing in the second screening, 0.71% children were found to be test-positive.[11] Prevalence of urinary disease varied in different studies probably because of different ethnic background, medical facilities.

In this study, the male to female ratio was 0.88:1 in the first screening. Park et al, have also shown that urinary abnormalities were more common in girls than in boys.[17] Lin et al, found more male to have urinary abnormality compared to female.[18] There was no difference in urinary abnormality with age or gender in study done by Vehaskari et al.[19] These studies were school based studies, hence difference in these findings may be due to a gender difference at school enrolment.

Children were also assessed for height, weight, Blood pressure. Among the clinical parameters studied, all parameters were similar in children with or without urinary problems. 2 children with proteinuria also had glycosuria. One child was diagnosed to have Type 1 DM with antibody GAD positivity while other had UTI.

In this study, four children had urinary tract infection and one child (12.5%) had Glomerulonephritis. Study by Parakh et al, showed five children (50%) had features of glomerulonephritis.[11] Similarly, Murakami et al, from Japan and Bakr et al, from Egypt reported glomerulonephritis in 76.6% and 66.6% of their children with confirmed urinary abnormalities, respectively.[15,20]

Bergstein et al, 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.[21] Similarly, Chander et al, 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.[22]

In the present study prevalence of UTIs in male was 0.2 and in female 0.8 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. Srinivasulu K et al, from Andhra Pradesh, India showed prevalence of UTIs in male was 0.57 and in female 2.02.[14] Turkish study by Nabigil and Tumer found that 4.5% of primary school children had UTIs.[23] Moreover, Litka et al, reported in a Japanese study that the prevalence of UTIs among school age children was 0.29%.[24] The difference of results in these studies may explained by difference in method of diagnosis and different socioeconomic status.

The urinary screening of school children by dipstick is a non-invasive and feasible test for early detection of silent renal diseases.[25] At present there is no clear consensus for developing countries on whether mass screening programs for CKD in children and adolescents should be undertaken. Mass urinary screening programs are well established in some Asian countries like Japan, Korea, and Taiwan. Sekhar et al, analysed the cost-effectiveness of urinary screening programs, found them to be an ineffective procedure for primary care providers.[26] Hence, a strategy must be made by pediatric nephrologists from developing countries regarding detection of renal disease in asymptomatic school children.

CONCLUSION

Early detection and prevention are important in clinical practice to help overcome the burden of the financial resources required for dialysis and transplant in kidney disease children. These facilities are not available at most centres in developing countries especially for younger children. Thus, school urinary screening program may have a long-term impact in reducing the burden of renal disease in children.

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