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Urinary Screening in Primary School Children in Yazd, Iran

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Background: Urinary screening program for asymptomatic urinary abnormalities among primary school children may facilitate preventing, halting, and deferring the progression of some diseases.
Objectives: To describe the urine examination findings in healthy primary school beginners in Yazd (Iran).
Patients and Methods: A complete physical examination in the morning with a midstream urine sample collection obtained from 3014 students in two educational areas of Yazd, Iran. Students with positive test results in the first screening were retested. The urine samples of those with two abnormal results were analyzed using dipstick and microscope concurrently.
Results: Children (1527 girls, 1487 boys) were screened and urinary abnormalities were detected in 94 (3.1%) subjects at the first screening. Proteinuria was the most common abnormality, detected in 54 (1.79%), and next, hematuria was present in 16 subjects. Of these children, 24 (0.79%) cases were positive in the second screening. In the third analysis of samples, abnormal findings in the patients included one isolated hematuria, eight isolated proteinuria, and two combined hematuria and proteinuria. 19 out of 3014 (0.63%) had a familiar history of renal diseases and three of them had renal disease.
Conclusions: Urinary screening can detect chronic renal disease in its earliest stages that may help to prevent the deterioration of future renal function. In addition, a long-term follow-up of the children with hematuria and proteinuria is suggested.

Keywords: Hematuria; Proteinuria; Mass Screening

1. Background

In the last three decades, urinary screening to diagnose asymptomatic renal disease in children is widespread in the developed countries (1, 2). In Asia, a program involving annual screening of primary school children is regularly conducted in Japan(1), Taiwan (3), and Korea (4). Dipstick urinalysis (DUA) remains a cornerstone to evaluate the kidney function at relatively low cost (5). Asymptomatic hematuria or proteinuria is commonly detected by a routine dipstick with a reported prevalence between 1%-10% for proteinuria, and 0.5%-2% for hematuria (6, 7). Isolated hematuria, as well as proteinuria, is usually benign, however persistent hematuria and/or proteinuria may be associated with serious underlying renal diseases or systemic disorders that require workup and referral to the nephrologists. School urinalysis screening allows early detection of the disease in its early stages and prevents the onset of renal insufficiency.

2. Objectives

The current study aimed to screen the urine of healthy primary school beginners in Yazd, Iran, for hematuria and proteinuria.

3. Patients and Methods

A cross-sectional study was conducted on 3014 subjects randomly selected from the first grade students of a primary school in Yazd from October 2007 to February 2008. The study was approved by the Ethics Committee of Yazd University of Medical Sciences. The students` parents were instructed to complete a questionnaire on the relevant demographic information and a sample of midstream urine was collected. They returned the questionnaires along with the urine specimens the following day. General physical examination (including controlling the weight, height, blood pressure, edema and paleness) was also carried out on each student by general practitioners. The first morning urine was examined by urine strips (dip sticks) (LABodia Co., Germany). In this screening program, the dipstick consisted of 10 reagents: pH, specific gravity, protein, blood, glucose, leukocytes, nitrites, urobilinogen, bilirubin, and ketones. A high-power field (HPF), when used in r elation to microscopy, references the area visible under the maximum magnification power of the objective being used. Children with abnormal findings called for the second urinary screening and if positive results were confirmed, a urine microscopic analysis was performed to examine the third urine sample. Those with persistent urinary abnormalities were

referred to specialists for further evaluation. One hundred-sixty-five students were excluded due to the recent history of antibiotic therapy. Informed consent letters were obtained from the children's parents and school managers. The data were analyzed by SPSS 12. A $P < 0.05$ was considered statistically significant.

Table 1. Urinary Findings in the First Screening

Urinary Finding	Boys	Girls	Total
Proteinuria	18	36	54
Hematuria	4	11	15
Nitrite+	0	21	21
Leukocyte esterase	0	10	10
Ketone	4	8	12

Table 2. Abnormal Urinary Test Results in the Second Stage

Urinary Finding	Boys	Girls	Total
Isolated Hematuria	1	1	2
Isolated Proteinuria	4	7	11
Combined hematuria and proteinuria	1	1	2
Leukocyte esterase	0	1	1
Nitrite+	0	5	5
Any urine abnormality [a]	0	3	3
Total	6	18	24

[a] dipstick-positive protein, blood, leukocyte and nitrite in combination.

Table 3. Prevalence of Symptoms in the Study Group (General and Urinary)

Symptom	Girls	Boys	Total
Anorexia	203	136	339
Poor weight gain	148	105	253
Nocturia	104	151	255
Lower abdominal pain	23	13	36
Dysuria	34	13	47
Incontinency	26	15	41
Flank pain	39	34	73

4. Results

A total of 3014 students (1479 boys and 1535 girls) were enrolled in the study, of whom 1484 (49.2 %) were from zone one, and 1530 (50.8 %) from zone two of Yazd city, Iran. Body Mass Index (BMI) of the subjects ranged between 10.23 and 25.02. There was no significant correlation between BMI and urinary abnormalities. At the first screening, 94 (3.1%) school children had urinary abnormalities. Proteinuria was the most common form of urinary abnormality found in 54 (1.79%) subjects. 15 cases showed positive results for blood, 10 for leukocyte estrase, 12 for ketones, and 21 for nitrite (Table 1). The prevalence of urinary abnormalities was higher in girls; however, no significant difference was observed in the prevalence of proteinuria between boys and girls. In the second stage of the study 24 (0.79%) abnormal urine samples were found (two isolated hematuria, 11 isolated proteinuria, 2 combined hematuria and proteinuria) (Table 2). In the final samples, after microscopic examination of urine, 18 students showed abnormal findings, including: Hematuria, nitrite+ and leukocyturia (n = 2), hematuria and proteinuria (n = 2), isolated hematuria (n = 1), nitrite (n = 4), leukocyturia (n = 1), isolated proteinuria (n = 8). Among eight students with positive results for protein, one was diagnosed with nephritic syndrome, five showed persistent proteinuria and were kept on follow-up, and two had hypertension. In one out of six children with hematuria in the second screening, the calcium-creatinine ratio was more than 0.21, which showed nephrolithiasis by ultrasonography during the follow-up. In the follow-up,12 new cases of renal diseases (0.5%) were found: Nephrolithiasis (n = 1), hypertension (blood pressure > 95th percentile for age), (n = 2), glomerulonephritis (n = 2), ectopic kidney (n = 1), and 6 patients with UTI (positive urine culture). Urinary symptoms were found in 33 questionnaires. Anorexia was the most common symptom in the subjects (11.24%) (Table 3). In the current study, urine specific gravity was more than 1.020 in 2427 cases (80.6%) due to inadequate water intake. The calculated cost for initial screening with a dipstick urinalysis was 0.001 Dollars per patient.

5. Discussion

Early diagnosis and prevention of renal diseases is the only way to prevent kidney failure, however, individuals with renal diseases often do not experience symptoms until reaching an advanced stage. Mass urinary screening helps to determine the prevalence of renal diseases in asymptomatic children. In the present study, only 3.1% of the school children had urinary abnormalities at the first screening, which was similar to the study by Hajar et al. (8) who screened 870 students in Lebanon and reported the prevalence of 2.9% at the first screening. However, it was lower than those of Shajari et al. (9) in Iran who reported a prevalence of 4.7% in the first screening and higher than 2.5% and 1.3% were reported in the Northern Iran and Egypt, respectively (10, 11). This higher prevalence could be due to the fact that more urine abnormalities than only the proteinuria and hematuria were tested in the current study where the prevalence of asymptomatic proteinuria, hematuria, nitrite and leukocyte esterase were 1.79%, 0.5%, 0.69%, and 0.29%, respectively. The prevalence of urine abnormality persisted in 0.79% on further testing in the second screening. It is compatible with the results of other studies that showed a prevalence of 0.72% and 0.71%, respectively (11, 12). Proteinuria is relatively common in children, with a reported prevalence of

1%-10%, while persistent proteinuria is much less common (13). In the current study, isolated proteinuria was the most common urinary abnormality with a prevalence of 1.79% in the first screening, which was lower than the 3.5% and 3.6% reported from different geographic regions of the world (9, 10). A cross-sectional study conducted in Lebanon reported that the prevalence of isolated proteinuria was 0.1%(8). Nepal, Malaysia, Egypt, and Shanghai reported prevalences of 0.22%, 0.12%, 0.12%, and 0.51%, respectively (11, 12, 14, 15). Akor et al. demonstrated that proteinuria was the most common urinary abnormality 3.5%, followed by hematuria 1.5% and both hematuria and proteinuria 0.2% on screening the children in Nigeria (16). There were other reports on the prevalence of hematuria and proteinuria among school children in various studies from different parts of the world (16-18). In some studies hematuria was the most common form of urinary abnormality (11, 19). The prevalence of asymptomatic microscopic hematuria among school-age children was estimated at 0.5% to 2.0% depending on the population screened (13). It was comparable to the current study results that showed a prevalence of 0.5%. Nigerian and Xiamen cities reported a prevalence of 1.5% and 1.21%, respectively (16, 20). On the contrary, hematuria had a lower prevalence in Malaysia, Egypt, and China 0.21%, 0.36% and 0.46%, respectively (11, 14, 15). Rao et al. conducted a study to determine the prevalence of urine abnormalities in school children in China. Proteinuria, occult blood, and glucosuria were detected in about 0.07%, 0.51%, and 0.06 % of the subjects, respectively (15). The current study reported that nitrituria was 0.69% at the first screening, which was lower than what was found by El-Abden et al. (1.6%) (13). Both findings of nitrituria and CHN (combined hematuria and nitrituria) increase the risk of urinary tract infections. In addition, the prevalence of proteinuria and/or hematuria may be related to different age groups. The findings of the current study were consistent with those of Parakh et al. who found that urinary abnormalities were more common in girls than boys (12). Other authors (21-23) also showed that urinary abnormalities were more frequent in girls compared with boys. Nitrituria was significantly higher in girls than boys due to their shorter urethra which makes them susceptible to ascending bacterial infection (24). Several studies indicated that urinary abnormalities are a common problem among boys and girls (25). Bakr et al. found that gender, age, or socioeconomic status had no effect on the prevalence of urinary abnormalities (11). In contrast, Lin et al. showed that microscopic urinary abnormalities were more common in males than females (26). Urine specific gravity was more than 1.020 in the present study that may indicate a relative dehydration. Ideally, the normal range for specific gravity of human urine is 1.002 to about 1.030. However, if specific gravity is above > 1.010, this can indicate mild dehydration which becomes more severe as the number increases. Two children had features of glomerulonephritis in the present study. Parakh et al. (12) from Nepal and Bakr et al. (11) from Egypt reported glomerulonephritis in respectively 50% and 66.6% of their subjects with confirmed urinary abnormalities. There are some controversies over the value of urine screening in school children. In the United States, mass screening of asymptomatic individuals is not found cost effective (27). Simonetti and Konrad also suggested that urine screening is not very useful and should be performed only at the age of five years or in sexually active adolescents (28). In another study Hanif et al. (29) suggested that urine analysis should be performed in all patients to identify the presence of unrecognized renal diseases, which may benefit from simple therapeutic measures. It is suggested that routine urine screening programs are implemented in school-age children, which is beneficial to the patients and, in many cases, cost-effective.

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