Screening for urine abnormalities among preschool children in western Saudi Arabia

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ABSTRACT

الأهداف: تقييم تكرار مشاكل المسالك البولية لدى الأطفال قبل سن الدراسة.

الطريقة: في هذه الدراسة المقطعية حضر 1000طفل دون سن الدراسة و بدون أي أعراض مرضية في قسم طب الأطفال في العيادات الخارجية لمستشفى جامعة الطائف،المملكة العربية السعودية خلال الفترة بين أغسطس 2013م وديسمبر2013 م و أجري لهم فحص تحليل البول. تم إجراء الفحص المجهري على عينات شرائط اختبار البول و فحص وظائف الكلى لدى الأطفال المصابين بالبيلة الدموية.

النتائج: كشفت نتائج تحليل البول مقياس غير طبيعي في 25.1% من الأطفال. كانت الأعراض غير الطبيعية الأكثر شيوعاً هو اختبار إيجابية النتريت في 18.1%، و 16.9% بيلة دموية، وإيجابي الكريات البيضاء لاختبار استريز في 14.3% من الحالات. و كانت أيضاً النتيجة الأكثر شيوعاً بلورات في 5% من الحالات. كانت لبيلة قيحية واضحة في 13% من الحالات ولبيلة دموية في 2.5%. وكانت البكتيريا الأكثر شيوعاً في عينات البول الإيجابية الإشريكية القولونية في 62.6%.

الخاتمة: في ضوء هذه النتائج المهمة، يجب تطبيق الفحص عند الأطفال قبل سن المدرسة.

Objectives: To estimate the frequency of urinary problems among preschool children.

Methods: In this cross-sectional study, 1000 preschool asymptomatic children attending the outpatient clinics of the Children's Hospital, Taif, Kingdom of Saudi Arabia between August 2013 and December 2013 were subjected to dipstick urine analysis. Microscopic examination was performed for the abnormal dipstick samples, and children with hematuria were investigated for kidney function.

Results: Dipstick urine analysis revealed abnormal findings in 25.1% of the screened children. The most common dipstick abnormalities were positive nitrite test in 18.1%, hematuria in 16.9%, and positive leukocyte esterase test in 14.3% of the cases. The most common abnormality in microscopic urine examination was crystals in 13% of the cases. Pyuria were evident in 5% of cases and hematuria in 2.5%. The most common bacteria in positive urine culture samples was *Escherichia coli* in 62.6%.

Conclusion: In view of these important findings, dipstick screening should be implemented in preschool children.

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Chronic kidney disease (CKD) is a global public health problem, its incidence is steadily increasing among children.[1] The Kingdom of Saudi Arabia (KSA) is a large country (26.9 million) populated with a high percentage of children; children aged 0-14 years represent 28.2% of the population.[2] The Kingdom of Saudi Arabia is similar to other developing countries in that there is no current national epidemiologic data on pediatric chronic renal failure (CRF) and its

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risks.[3] Detection and management of renal problems in children are of major importance for CKD prevention; this in turn will decrease the burden of CKD in the pediatric population.[4] Urinalysis is recognized as the simplest and least expensive method for screening healthy children and dipstick method is the most commonly implemented procedure.[5] Moreover, dipstick has proven effective in prediction of rapidly declining kidney function.[6] It must be recognized that not all abnormal results are clinically significant, and that false positive and false negative results can exist.[7] Moreover, there is uncertainty as to whether early detection of renal disorders in children will lead to prevention of development of end-stage renal disease (ESRD). However, there is a clear consensus among Japanese, Taiwanese, and Korean investigators that the screening programs currently in place in these counties have led to early detection and effective intervention.[8] Proteinuria and hematuria are among the early manifestations of renal disease.[9] The presence of a dipstick test 1+ or ≥2+ for proteinuria was strongly associated with renal risk.[10] Hematuria can be caused by several conditions, including infections, stone disease of the urinary tract, glomerular, and tubular disorders.[11] Nitrite in urine has also been used to diagnose urinary tract infection; a common condition in childhood with serious complications.[12] The treatment of persistent proteinuria should be directed toward the underlying cause. Steroid therapy may be used. Other therapies may be required in patients with renal dysfunction (namely, cyclophosphamide, chlorambucil, cyclosporine). Additionally, angiotensin-converting enzyme inhibitor and/or angiotensin-II receptor blocker can be used to the slow progression of renal disease and decreasing proteinuria. Referral to a pediatric nephrologist may be needed for further management.[13] The aim of the current study was to screen for hematuria and other urine abnormalities among children in Taif city, as early detection could aid in preventing the progression of renal diseases.

Methods.

Study design and settings. This cross-sectional study was conducted at the Children Hospital, Taif, Kingdom of Saudi Arabia. This hospital is government-funded, and serves approximately 400 children daily.

This study was approved and funded by the Review Board Committee of Taif University. We included all preschool children (aged 3-6 years) with no history of renal disease. These subjects were accompanying sick children who attended the outpatient clinics during the period from August 2013 to December 2013. Exclusion criteria were children with fever, abdominal pain, vomiting, diarrhea, acute voiding symptoms, facial or leg swelling, and children with severe malnutrition or other chronic debilitating diseases. A written consent was obtained from parents prior to the start of the study.

Screening protocol. Urine containers were collected from the children after instructing their parents on how to obtain a clean midstream urine specimen. Parents were also given a questionnaire on family history of renal problems, residence, mothers' education, mothers' work, family income, and crowding index. Urine specimens were tested for physical characters including abnormal color or aspect and examined immediately by dipstick method. In this study, the dipstick was adopted from the Medi-Test combi 10® (SGL, Düren, Germany), consisting of 10 reagents, including: pH, specific gravity, protein, blood, glucose, leucocytes, nitrite, urobilinogen, bilirubin, and ketones. Children with positive dipstick results were subsequently subjected to microscopic urine examination and urine culture. For cases with hematuria, blood samples were collected and sent for urea, creatinine, and uric acid measurements.

The following case definitions were applicable: 1) hematuria: more than 5 red blood cells per high power field (RBC/HPF) 2) Pyuria: more than 10 white blood cells per high power field (WBC/HPF). 3) ≥1 proteinuria. 4) ≥1 glycosuria.
5) positive nitrite.

Statistical analysis. Data was analyzed using the Statistical package for Social Sciences Version 20.0 (Armonk, NY: IBM Corp.). The frequency tables (number, percentage) were calculated for all measurements. Chi-square test was used for comparison of categorical variables. Significance was detected at $p<0.05$.

Results.

Table 1 shows that 1000 apparently healthy children were included in this study. Six percent (n=60) had a family history of renal problems, and 7.8% (n=78) were overweight. Most of the studied children were aged 60-72 months. Approximately 51% were females and nearly 62% were rural residents. Most of their mothers were educated housewives and most parents were unsatisfied with their income. **Table 2** reveals that from the 25 hematuria cases, 3 had elevated blood urea, 8 had elevated serum creatinine and 7 had hyperuricemia. **Figure 1** shows that dipstick examination of urine samples revealed abnormal results in screened children, positive nitrite, hematuria, positive leukocyte esterase, glucose, and protein. **Figure 2** shows that microscopic examination of abnormal dipstick urine samples showed crystals and epithelial cells. Pyuria was evident in 50

cases while hematuria was present in 25 cases. **Figure 3** shows that the most common bacteria encountered in the positive urine cultures, were *Escherichia coli (E. coli)* in 62.6% (15 cases), followed by *Enterococci* in 20.8% (5 cases). The only microscopic urine findings that differed significantly between male and female children were crystals and epithelial cells; they were significantly higher in females. The variables were examined using Chi-square test. Statistical significance was defined as *p*-values of less than 0.05.

Discussion. In developing countries, the national epidemiologic data on chronic kidney disease in the pediatric population is currently limited.[14] A cornerstone in evaluation of kidney function is the urine analysis, which is a simple and inexpensive test. Dipstick method is the most rapid screening procedure used in early detection of urinary tract diseases; thus, helping prevention and retarding progression to chronic renal failure.[15]

Table 1 - Children characteristic among 1000 apparently healthy children.

Children characteristic	n (%)	
Age (months)		
36 to <48	253	(25.3)
48 to <60	311	(31.1)
60 to <72	436	(43.6)
Gender		
Male	493	(49.3)
Female	507	(50.7)
Residence		
Rural	622	(62.2)
Urban	378	(37.8)
Mother education		
Illiterate	89	(8.9)
Educated	911	(91.1)
Mother occupation		
House wife	790	(79.0)
Worker	210	(21.0)
Family income		
Not enough	619	(61.9)
Enough	381	(38.1)

Six percent (n=60) had a family history of renal problems and 7.8% (n=78) were overweight

Table 2 - Investigations carried out for the 25 cases with microscopic hematuria.

Test	Cases with hematuria n (%)
Blood urea	3* (12.0)
Serum creatinine	8† (32.0)
Serum uric acid	7‡ (28.0)

*maximum reference range, >45 mg/dl,
†maximum reference range, >0.6 mg/dl,
‡maximum reference range, >5.8 mg/dl

In our study, the dipstick urine analysis revealed that 25% of the screened children had urinary abnormality. Similarly, a high prevalence of urinary abnormality (up to 30%) among children has been reported by different authors in different regions all over the world.[16,17] Proteinuria and hematuria are the most important laboratory signs of renal disease in children.[13] Proteinuria is considered a strong independent risk

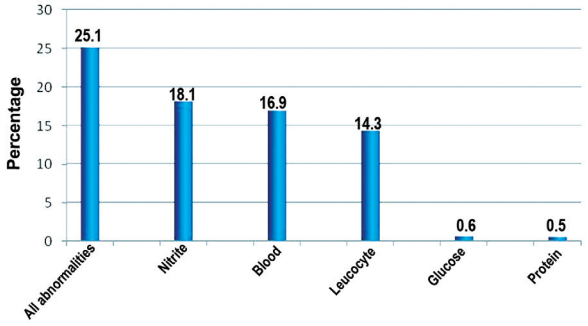

Figure 1 - Frequency of dipstick examination of urine samples among screened children (N=1000).

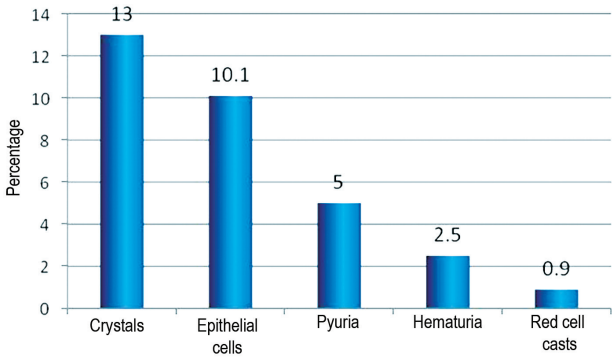

Figure 2 - Microscopic examination of abnormal dipstick urine samples among the 251 cases positive by dipstick.

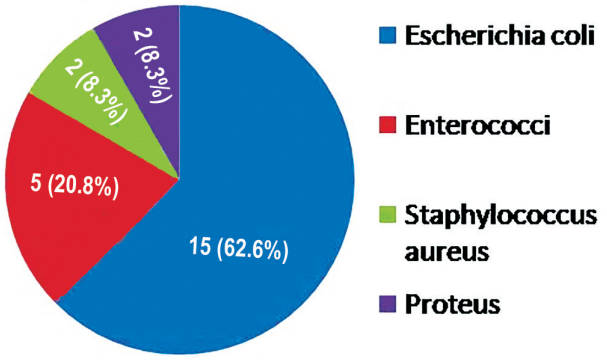

Figure 3 - Distribution of bacteria in positive urine culture among 24 cases.

factor of end stage renal disease. Thus, asymptomatic proteinuria warrants attention for early detection and management.[18] The most important causes of hematuria in young age are renal stones, structural abnormalities of the urinary tract, or parenchymal renal diseases.[19] In our study, dipstick-detected hematuria was encountered in 17% and proteinuria in 0.5% of the cases. Inversely, in a study conducted among Indian schoolchildren, the prevalence was 16% for proteinuria and 5% for hematuria.[20] In agreement with our results, a survey conducted in Makkah among schoolchildren, revealed 14.75% of the screened children had hematuria.[21] In concordance with these results, there is also a study on schoolchildren in Shanghai which reported a prevalence of 0.5% of children having proteinuria.[22]

Glucosuria and positive nitrite were another abnormality in our study; glucosuria was detected in 0.6% of children (no ketones detected in urine), and positive nitrate in 18.1%, which is similar to the studies carried out in Shiraz, Iran (glucosuria was 0.2% and positive nitrite was 18%).[5] Detectable nitrite in urine has been used to diagnose urinary tract infection; a very common disorder in children.[23]

The presence of hematuria must be confirmed by microscopic examination of urine because other substances besides blood can produce red or brown urine or give a false positive dipstick test for blood.[24] The development of asymptomatic microscopic hematuria is relatively common in children. Its prevalence in pre-school aged children is 0.5-2.0% depending on the population screened.[15] This is comparable with our results that showed a prevalence of 2.5% (in the abstract section was 9.9%?. The most prevalent microscopic finding in our study was crystalluria, which was evident in 13% of children (in the Abstract was 51.8%?, please check). Crystalluria is a global reflection of the risk of stone formation and therefore, the physician should be alerted by this finding in urine analysis. Our results are in concordance with Arustamov and Nurullaev[25] study who found that crystalluria among children aged between one and 5 years, was encountered in 17.3% of the cases. *Escherichia coli* is the most frequent organism isolated from subjects with asymptomatic bacteriuria.[26] This fact is consistent with our findings where *E. coli* was the most common pathogen identified in culture, accounting for 62.6% of isolated organisms. Our study showed that gender had a significant impact on some results as for crystals and epithelial cells, which were more prevalent in females. However, this was not in concordance with the study carried out in Basra city in Iraq, regarding crystalluria, which found no significant difference between males and females.[27]

In conclusion, urinary abnormalities are common among apparently healthy children. We strongly recommend the implementation of a national screening program for urinary problems in childhood as an early way of detection that could mandate early intervention before a permanent or chronic renal or urinary tract damage takes place.

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