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Original Article

Prevalence of Asymptomatic Urinary Abnormalities Among Primary School Children in Damietta Governorate

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معدل الإنتشار لمشاكل الجهاز البولى الغير ظاهرة بين أطفال مدارس التعليم الأساسى فى محافظة دمياط

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الملخص

يفيد إجراء عملية المسح لمشاكل الجهاز البولى الغير ظاهرة فى الإكتشاف المبكر لأمراض الكلى ولتحسين كفاءتها الوظيفية . وتعتبر طريقة الغمر العصوى من أكثر طرق المسح شيوعا للإكتشاف المبكر لمشاكل الجهاز البولى الغير ظاهرة. وقد اجريت هذه الدراسة لتحديد معدل الإنتشار لمشاكل الجهاز البولى الغير ظاهرة بين أطفال مدارس التعليم الأساسى فى دمياط ولرفع وعيهم تجاه هذه المشاكل .

وقد تم اجراء دراسة مقطعية على 2873 من الأطفال الأصحاء من 22 مدرسة تعليم أساسى وتم استخدام طريقة الغمر العصوى لإجراء المسح البولى وتبع ذلك إجراء تثقيف صحى للأطفال .

وقد وجد بعد اجراء المسح الأول أن 64 طفلا (2.2%) يعانون من مشاكل بولية منهم 35 طفلا فقط (1.2%) مازال عندهم مشاكل بولية مستمرة بعد الفحص الثانى مع وجود فروق ذات دلالة احصائية بين الأولاد والبنات وبين أطفال الريف والحضر وكذلك بين أطفال المدارس الحكومية والخاصة . ومن بين الخمسة والثلاثين طفلا الذين يعانون من مشاكل بولية مستمرة وجد أن منهم 7 أطفال (0.24%) يعانون من وجود دم بالبول و 5 أطفال (0.17%) يعانون من وجود بروتين بالبول و 6 أطفال (0.21%) يعانون من وجود خليط من الدم والبروتين بالبول و7 أطفال (0.24%) يعانون من وجود صديد بالبول و 4 أطفال (0.14 %) يعانون من وجود سكر بالبول و 6 أطفال (0.21%) يعانون من وجود أملاح بالبول.

كما وجد انه من بين 18 طفلا يعانون من الوجود المستمر للدم أو للبروتين أو كليهما بالبول ، هناك 5 منهم (27.8%) يعانون من وجود إلتهابات الكلى . وقد أظهرت النتائج الدلالة العالية لطريقة الغمر العصوى فى اجراء المسح لمشاكل الجهاز البولى الغير ظاهرة.

وقد اظهر هذا البحث أن مشاكل الجهاز البولى الغير ظاهرة تمثل نسبة بسيطة من أطفال مدارس التعليم الأساسى فى دمياط، وأن التهابات الكلى الحادة التى تلى الإصابة بالميكروب السبحى من أهم أسباب هذه المشاكل، ويعتبر الغمر العصوى طريقة مقبولة عند إجراء المسح البولى والذى يساهم فى الإكتشاف المبكر لأمراض الجهاز البولى. و يجب تقدير نسبة التكلفة والمنافع لفئات بعينها قبل اجراء مثل هذه البرامج.

ABSTRACT

Background: Screening for asymptomatic urinary abnormalities is useful for early detection of renal diseases and to improve its outcome.Dipstick method is the most common screening procedure for early detection of asymptomatic urinary abnormalities. This study was undertaken to determine the prevalence of silent urinary abnormalities among primary school children in Damietta and to raise their awareness. A cross section study was conducted on 2873 healthy children from 22 primary schools. Dipstick method was used for urinary screening. Health education was conducted to children after screening. At the first screening, 64 children (2.2%) had urinary abnormalities and only 35 (1.2%) of them had persistent abnormalities at the second screening with significant difference between boys and girls, rural and urban children, and between children of public and private schools. Of the 35 children with persistent urinary abnormalities; 7 (0.24%) had isolated hematuria (IH), 5 (0.17%) had isolated proteinuria (IP), 6 (0.21%) had combined hematuria and proteinuria (CHP), 7 (0.24%) had pyuria, 4 (0.14%) had glycosuria, and 6 (0.21%) had crystalluria. Of the 18 children with persistent hematuria and/or proteinuria, 5 (27.8%) had evidence of glomerulonephritis (GN). Screening of asymptomatic urinary abnormalities by dipstick method showed high validity.

Conclusion: Asymptomatic urinary abnormalities were detected in a small number of primary school children in Damietta. Acute poststreptococcal glomerulonephritis (APSGN) was the leading cause for these abnormalities. Dipstick test is accepted in mass urinary screening to allow early detection of urinary diseases. The cost-benefit ratio for specific populations should be determined before the implementation of such programs.

Key words: *Asymptomatic urinary abnormalities, Dipstick method, Primary school children, Hematuria, Proteinuria, Health education.*

INTRODUCTION

The increasing incidence of chronic renal diseases among both children and adults is a global health problem [1]. Screening for asymptomatic urinary abnormalities (AUA) is useful for early detection of renal diseases and asymptomatic infections, particularly among children [2]. Because of its simplicity, urine analysis using the dipstick method is the most common screening procedure for early detection of AUA at a relatively low cost. It can be a guide for further evaluation of renal diseases and may help to avoid unnecessary investigations [3]. The justification for screening of AUA of childhood remains questionable given their relative relation with acute renal diseases, which may help to prevent progression into chronic renal illness and renal failure [4]. This study was conducted to determine the prevalence of AUA among apparently healthy primary school children in Damietta and to raise their awareness regarding specific hygienic protective measures through health education.

MATERIAL AND METHODS

This cross section study was carried out from November 2011 to July 2012 on 2873 apparently healthy primary school children from Damietta governorate in the northeast part of Egypt. The children were selected, by simple random sampling, from 22 primary schools. In each school, children were recruited from all grades, by stratified random sampling, with a total number ranging from 110 – 140 children per school. The study was approved by the local Institutional Ethics Committee and informed consent was obtained from the children's parents or caregivers and school directors.

Participants were instructed to void a clean catch mid stream urine specimen into a 200 ml sterile vessel, which was sent to a clinical pathology laboratory. A dipstick test (Multistix, Bayer Diagnostics, Miles Inc., USA) was performed on the urine specimen by trained laboratory technicians, with the reagent strip designed to react progressively producing color changes in given intervals. The results were decided by visual comparison of the test strip with a color chart provided on the bottle label. Urine samples were then prepared for microscopic analysis.

After screening, simple hygienic recommendations were conducted to primary school children and school staff through a health education session.

Abnormal urine findings were considered if one or more of the following were detected: hematuria (a red blood cell count of 5 or more per high power field), proteinuria {protein 1+ (30 mg/dL), 2+ (100 mg/dL), 3+ (300 mg/dL), and 4+ (1000–2000 mg/dL)}, pyuria (presence of more than 3 to 5 white blood cells per high-power field), glycosuria, and crystalluria. Children with positive results received a second urinary screening 10-15 days later and those with persistent abnormal findings were subjected to further evaluation then prepared to referral to a nephrologist. In case of hematuria, acute poststreptococcal glomerulonephritis (APSGN) was confirmed by presence of urinary red cell casts, low serum C3 level, and evidence of recent streptococcal infection by elevated antistreptolysin O titer. In case of proteinuria, fixed proteinuria, suggesting glomerular or tubular renal disorders, was confirmed by protein/creatinine ratio > 0.2. In case of pyuria, asymptomatic urinary tract infection (asymptomatic bacteriuria) was confirmed by a positive urine culture that showed >100,000 colonies of a single pathogen. In case of glycosuria, hyperglycemia was confirmed by random blood glucose greater than 200 mg/dL (11.1 mmol/L). In case of crystalluria, hypercalciuria, suggesting liability to renal stones, was confirmed by a calcium/ creatinine ratio ≥ 0.2.

Statistical analysis Statistical analysis was carried out using the SPSS computer package version 17.0 (SPSS Inc., Chicago, IL, USA). Qualitative data were expressed in the form of numbers and percentages. In order to assess the differences in frequency of qualitative variables, Chi-square test was used.

A *P*- value $\leq$ 0.05 was considered statistically significant.

RESULTS

The total number of primary school children in Damietta governorate was 149312, 56% lived in rural areas and 55% were boys. The children were selected by simple random sampling from 22 primary schools: 12 public schools in rural areas and 10 in urban areas (5 private and 5 public schools).Of the selected 2873 children, 1635 (56.9%) were from rural areas, whereas 1238 (43.1%) were from urban areas. Among them, 1663 were boys (57.9%) and 1210 girls (42.1%). Their ages ranged from 6 to 13 years (Table 1).

Table (1): General characteristics of the studied children.

Parameters \ Children		No.	%
Location of Schools (n= 22)	Rural	12	54.6
	Urban (Public)	5	22.7
	Urban (Private)	5	22.7
Residence of children (n= 2873)	Rural	1635	56.9
	Urban	1238	43.1
Gender of children (n= 2873)	Boys	1663	57.9
	Girls	1210	42.1
Age of children (years)	Mean $\pm$ SD	8.4 $\pm$ 1.2	
	Minimum - maximum	6 – 13	

At the first screening, 64 children (2.2%) had urinary abnormalities. However, only 35 (1.2%) of them had persistent urinary abnormalities at the second screening. Significant difference was observed in the prevalence of urinary abnormalities between boys and girls, between rural and urban children, and between children of public and private schools. However, no significant difference was observed between older and younger children (Table 2).

Table (2): Characteristics of the studied children according to urinary abnormalities.

Characteristics \ Abnormalities		Positive (N=35)		Negative (N=2838)		Total (N=2873)		*P*-value
		No.	%	No.	%	No.	%	
Gender	**Males**	14	0.49	1649	57.40	1663	57.9	0.038 *
	Females	21	0.73	1189	41.38	1210	42.1	
Age	**<10y**	16	0.56	1710	59.52	1726	60.1	0.085
	≥10y	19	0.66	1128	39.26	1147	39.9	
Residence	**Rural**	26	0.90	1609	56.00	1635	56.9	0.040 *
	Urban	9	0.31	1229	42.78	1238	43.1	
School	**Public**	22	0.77	2252	78.38	2274	79.2	0.033 *
	Private	13	0.45	586	20.39	599	20.8	

Values presented as numbers and percentage and analyzed by Fisher's Exact test. *: Significant.

Of the 35 children with persistent urinary abnormalities; 7 children (0.24%) had isolated hematuria (IH) [2 children (0.07%) were confirmed to have APSGN and 2 children (0.07%) were confirmed to have hypercalciuria], 5 children (0.17%) had isolated proteinuria (IP) [3 children (0.10%) were confirmed to have fixed proteinuria and one child (0.03%) with orthostatic proteinuria] and 6 children (0.21%) had combined hematuria and proteinuria (CHP) [3 children (0.10%) were confirmed to have APSGN and one child (0.03%) with orthostatic proteinuria] (Table 3), 7 children (0.24%) had pyuria of which 5 children

(0.17%) were confirmed to have asymptomatic UTI (3 with E coli, one with enterococci, and one with staphylococcusaureus) (Figure 1), 4 children (0.14%) had glycosuria of which only one child (0.03%) was confirmed to have hyperglycemia, and 6 children (0.21%) had crystalluria of which 2 children (0.07%) were confirmed to have hypercalciuria and liability to renal stones (Table 4). The remaining was considered undetermined causes that need further investigations.

Table (3): The patterns of renal diseases in children with persistent hematuria and/or proteinuria.

Symptoms / Patterns	IH (N=7)	IP (N=5)	CHP (N=6)
APSGN	2 (0.07%)	-	3 (0.10%)
Fixed proteinuria	-	3 (0.10%)	-
Orthostatic proteinuria	-	1 (0.03%)	1 (0.03%)
Hypercalciuria	2 (0.07%)	-	-
Undetermined causes *	3 (0.10%)	1 (0.03%)	2 (0.07%)

IH: isolated hematuria; IP: isolated proteinuria; CHP: combined hematuria and proteinuria;
* Undetermined causes may include: other types of glomerulonephritis and IgA nephropathy that should be confirmed by renal biopsy.

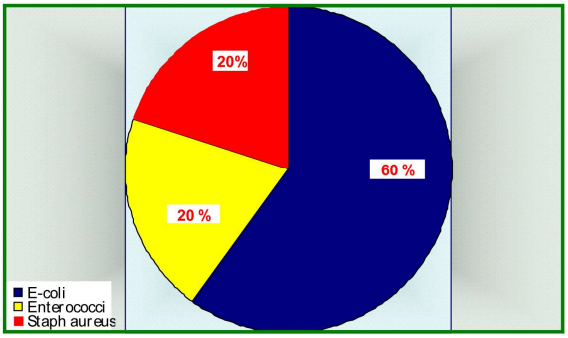

Figure (1): Isolated microorganisms among children with asymptomatic UTI.

Table (4): Distribution of renal diseases among children with persistent urinary abnormalities.

Urinary screening (N = 35) / Abnormalities		No.	% (n= 2873)
Isolated hematuria (n= 7)	APSGN	2	0.07
	Hypercalcinuria	2	0.07
	Undetermined causes	4	0.14
Isolated proteinuria (n= 5)	Fixed	3	0.10
	Orthostatic	1	0.03
	Undetermined causes	1	0.03
Compound Hematuria & Proteinuria (n= 6)	APSGN	3	0.10
	Orthostatic	1	0.03
	Undetermined causes	2	0.07
Pyuria (n= 7)	Asymptom. UTI	5	0.17
	Undetermined causes	2	0.07
Glycosuria (n= 4)	Hyperglycemia	1	0.03
	No Hyperglycemia	3	0.10
Crystalluria (n= 6)	Hypercalciuria	2	0.07
	Undetermined causes	4	0.14

Hematuria detected by dipstick method (isolated and combined) was confirmed by microscopic detection of RBCs with sensitivity of 84.6 %, specificity of 90.9 %, and accuracy of 88.6% (Table 5).

Table (5): Validity of dipstick test in diagnosis of hematuria.

Microscopic RBCs detection / Dipstick method	Hematuria	No Hematuria
Positive test	11 (True +ve)	2 (False +ve)
Negative test	2 (False –ve)	20 (True –ve)
Total	13	22

Pyuria detected by dipstick method was confirmed by urine culture with sensitivity of 100.0 %, specificity of 93.3 %, and accuracy of 94.3% (Table 6).

Table (6): Validity of dipstick test in diagnosis of pyuria.

Urine culture / Dipstick method	Pyuria	No Pyuria
Positive test	5 (True +ve)	2 (False +ve)
Negative test	0 (False –ve)	28 (True –ve)
Total	5	30

DISCUSSION

Routine urinalysis of asymptomatic patients has been shown to detect a variety of urinary tract disorders [5]. Prevalence studies have shown that asymptomatic urinary abnormalities may often be missed on history and physical examination, and the decision for screening must balance the risk for missed infections with the cost and inconvenience of testing [6]. Reports on the prevalence of asymptomatic urinary abnormalities among children in Egypt are generally lacking. Only 2.2% of the screened children had urinary abnormalities at the first screening that persisted in 1.2% at the second screening. Bakr et al screened 1670 Egyptian children from Dakahlia governorate where only 22 children (1.3%) had urinary abnormalities at the first screening that persisted in 12 children (0.72%) at the second screening [7]. In a Bolivian study, screening of 14082 subjects revealed urine abnormalities in 4261 subjects (30.3%) at the first screening and in only 1019 (7.2%) subjects at the second screening [8]. Zainal et al screened 45149 primary school children for proteinuria and hematuria and reported that 1.9% had positive results, but only 0.12% were found to be positive on further evaluation [9]. Other studies from Japan [10], Taiwan [11] and Nigeria [12] reported urinary abnormalities in 0.62%, 0.3%, and 9.6%, respectively, among elementary school children. This variance in prevalence rates during childhood may refer to differences in age, gender, and other factors such as uncircumcision [13], genitourinary tract abnormalities [14], abnormal voiding habits [15], and genetic tendencies such as lack of secretion of carbohydrates that protect against bacterial adherence in the urinary tract [16].

Our results showed that the prevalence of urinary abnormalities was significantly higher among females, among those living in rural areas, and among subjects in public schools (P= 0.038, 0.040, and 0.033, respectively). However, age had no impact on the prevalence of urinary abnormalities. On the other hand, Bakr et al found that gender, age or socioeconomic status had no impact on the prevalence of urinary abnormalities [7]. Similarly, Vehaskari et al found that the prevalence of urinary abnormalities was not age- or sex-dependent [17]. However, Oviasu and Oviasu showed that microscopic urinary abnormalities were more common in girls than in boys in Nigeria [18]. Also, Hajar et al found that urinary abnormalities were more common in girls than in boys in Lebanon [19]. The relatively higher prevalence among girls may be due to the shorter length of the female urethra so the periurethral area is colonized by both anaerobic and aerobic bacteria [20]. Other contributing factors may include bubble baths, tight-fitting clothes or wiping from back (near the anus) to front after going to the bathroom. In girls, this can bring bacteria to the urethral orifice [21].

Among children with urinary abnormalities, the male to female ratio was 0.67:1. Bakr et al reported a relatively similar male to female ratio of 0.71:1 among Egyptian children in Dakahlia governorate [7]. Lin et al reported a male to female ratio of 1.08:1 in Taiwan children [22]. A ratio of 0.94:1 was reported in Korean children [11].

Our results revealed that IH and pyuria were the most common urinary abnormalities (each of 0.24%) of the screened children while IP and CHP were found in 0.17% and 0.21%, respectively. In their study, Bakr et al found that IH was found in 0.36% of the screened children while IP and CHP were found in 0.12% and 0.24%, respectively [7]. Among primary school children in

Malaysia, urinary screening demonstrated that IP was the most common urinary abnormality (0.12%), followed by IH (0.03%) and CHP (0.02%) [9]. Among elementary school children in Korea [23] and Japan [10], the prevalence of IH and IP was 0.54% and 0.05%, and 0.64% and 0.48%, respectively. The highest prevalence of IH (46.4%) and CHP (14.3%) were reported by Lin et al after screening of 573 Taiwanese children with silent urinary abnormalities [22].

Yap et al discussed the role of urinary screening programs in prevention of chronic kidney disease among school children in Singapore. On the first urinary screening of 2325 twelve-year-old school children, IH, IP and CHP were positive in 6.8%, 1.2% and 2.3% of the children respectively [24].

APSGN is prevalent in Egypt as infection by β-hemolytic streptococci is still endemic. Of the 18 children with persistent hematuria and/or proteinuria, 5 (27.8%) had evidence of GN with possibility of other cases if renal biopsy was done. Hypercalciuria, renal stone, fixed and orthostatic proteinuria were the other underlying causes. No obvious causes were identified in 6 children. Results reported by Bakr et al showed that glomerulonephritis (GN) was the most common responsible underlying cause of persistent urinary abnormalities as 8 out of 12 children with persistent urinary changes (66.7%) had evidence of GN after renal biopsy [7].

In the same context, other several studies have confirmed that GN is the major cause of urinary abnormalities [11, 22, 25]. However, no cause was discovered by Bergstein et al in about 80% of children with microscopic hematuria and the most common cause of the disease was hypercalciuria (16%) [26]. Similarly, Chander et al reported that 52.1% of children with silent urinary abnormalities had no definite diagnosis, but hypercalciuria and organic renal diseases accounted for 14.4% and 14.9%, respectively [27].

An extensive evaluation is usually not necessary among children and adolescents with silent hematuria as favorable prognosis is usually predicted [24]. However, follow up is required after careful evaluation to exclude UTI, hypercalciuria, APSGN, and structural urinary abnormalities [28].

Proteinuria is a strong predictor and risk factor of End Stage Renal Disease (ESRD). Therefore, asymptomatic proteinuria warrants further work up and intervention to reduce the incidence of ESRD [29]. The most common causes of persistent pathological proteinuria in children include focal segmental glomerulosclerosis, IgA nephropathy, and membranoproliferative GN confirmed by renal biopsy [30]. Patients with CHP usually have more pathological changes than in those with IH or IP [11] that is correlated well with the severity of morphological alterations of glomeruli in the school age children [31].

Our results revealed that pyuria was present in 0.24% and glycosuria in 0.14% (glycosuria in the absence of hyperglycemia suggests renal glycosuria or proximal tubular disease). These results were comparable to some other studies. In their study of urinalysis in primary health care centers in Saudi Arabia, Al-Homrany et al found that glycosuria was present in 4.7% and pyuria in 10.6% of patients [32].

Our results agreed with the literature in that E. coli was the most common encountered microorganism among children with asymptomatic UTI [33, 34, 35].

Our results showed high validity of the dipstick method in screening of asymptomatic urinary abnormalities with high sensitivity and specificity.

In conclusion, asymptomatic urinary abnormalities are not prevalent in considerable percentage among primary school children in Damietta, and APSGN is the leading cause for these abnormalities. Dipstick test is valid in mass urinary screening. The cost-benefit ratio for specific populations should be determined before the implementation of such programs.

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