

Screening For Asymptomatic Renal Disease among School Children by Urinalysis

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Abstract

Early detection of asymptomatic renal disease in children is crucial for preventing long-term complications. School-based screening through urinalysis offers a practical approach for this purpose. A cross-sectional, descriptive study was conducted in Community-Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, between January and December of 2019, to screen for asymptomatic renal disease among school children in Mymensingh, Bangladesh, using urinalysis and to determine the prevalence of urinary abnormalities. Apparently healthy children aged 6-11 years from two purposively selected schools were included. Those with a history of renal disease, acute or chronic illness, and menstruating girls were excluded. After obtaining ethical approval and informed consent, participants underwent chemical and microscopic urinalysis. Among 200 children screened (mean age 8.4±1.4 years, 54.5% male), urinary abnormalities were found in 9.5% (n=19). Proteinuria was the most common finding (5.5%), followed by pyuria (5.0%) and hematuria (3.0%). The prevalence of abnormalities increased significantly with age ($p<0.05$). A significant association was found with hypertension ($p<0.05$) and higher BMI (overweight/obese, $p<0.05$). No significant gender difference was observed. Presumptive diagnoses included urinary tract infection (2.0%), glomerulonephritis (1.0%), and renal stone (0.5%). A significant proportion of asymptomatic school children screened had urinary abnormalities suggestive of underlying renal disease. These findings underscore the value of routine school-based urinalysis screening programs for the early detection and management of renal disorders in children.

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Introduction

Renal diseases in children represent a significant global health challenge, with the potential to progress silently to end-stage renal disease (ESRD) if not detected and managed early.¹ The insidious nature of pediatric renal conditions is particularly concerning; children can remain asymptomatic for years while sustaining irreversible damage to their nephrons, ultimately impacting their long-term health, growth, and quality of life.^{2,3} This silent progression underscores the critical need for proactive screening strategies aimed at identifying asymptomatic disease at a stage where interventions can halt or slow its advancement. The burden of chronic kidney disease (CKD) in the pediatric population is substantial.⁴ Epidemiological studies indicate a rising incidence worldwide, with etiologies ranging from congenital anomalies of the kidney and urinary tract (CAKUT) to acquired glomerulonephritis and hereditary disorders.^{4,5} The long-term consequences are severe, including cardiovascular complications, metabolic

abnormalities, and increased mortality rates.⁶ In low- and middle-income countries (LMICs), the challenges are amplified by limited healthcare

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access, delayed diagnoses, and poorer outcomes, placing a greater economic and social strain on families and healthcare systems.^{7,8} School-aged children represent a particularly vulnerable yet accessible group for screening initiatives. This period of life is characterized by rapid growth and development, processes that can be severely compromised by underlying renal dysfunction.⁹

Furthermore, identifying abnormalities in this age group can often provide a window into conditions that may have been present since birth or early childhood. School-based health programs offer a unique and efficient platform for reaching a large cohort of children outside of the traditional clinical setting, ensuring inclusivity and maximizing coverage.¹⁰ Urinalysis is universally recognized as a simple, non-invasive, and cost-effective tool for the initial screening of renal pathology.¹¹ The detection of seemingly minor abnormalities, such as low-grade proteinuria, microhematuria, or leukocyturia, can be the first crucial indicator of serious underlying conditions like glomerulonephritis, tubulointerstitial disease, or urinary tract infections (UTIs).¹² For asymptomatic children, these findings would otherwise go unnoticed without a systematic screening approach. Several studies have demonstrated the effectiveness of urinalysis in identifying previously undiagnosed renal diseases in school children, validating its role as a primary screening instrument.¹³⁻¹⁵ In Bangladesh, there is a scarcity of recent data on the prevalence of asymptomatic renal disease among the school-aged pediatric population. Existing studies are often dated or limited to hospital-based settings, which fail to capture the community-wide burden of silent disease. Therefore, this study aimed to screen for asymptomatic renal disease among school children in Mymensingh region, Bangladesh, using urinalysis.

The findings will contribute valuable local epidemiological data and help assess the feasibility and necessity of implementing a larger-scale, national school screening program.

Methods

This cross-sectional, descriptive cross-sectional study was carried out in Community-Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, between January and December of 2019. All the children of selected schools were the study population. However, two schools of Mymensingh city were selected purposively. Apparently healthy school children between the ages of 6 to 11 years were selected. However, children with a history of any renal disease, any acute or chronic illness, and menstruating girls were excluded. Blood pressure was measured by adopting standard procedure for children. Chemical and microscopical urine examinations were done for each child.

Data was collected through a semi-structured questionnaire and medical records of the children. Data was collected, compiled, coded and analyzed using Statistical Package for Social Sciences (SPSS) version 23.0 for Windows. Z-proportion test and Chi-square test were applied to compare between groups. A p-value <0.05 was considered statistically significant.

Ethical approval was taken from the Ethical Review Committee of Community-Based Medical College, Bangladesh (CBMC,B), Mymensingh Bangladesh. Informed written consent was taken from all parents. Besides, assents were taken from all the children who participated.

Results

A total of 200 school children were screened. The mean age was 8.4 ± 1.4 years. Most of the participants belonged to the 7-8 years age group 45 (22.5%) and 8-9 years age group 43 (21.5%). Male-female ratio was 1.2:1. According to BMI, 51(25.5%) were underweight, 123(61.5%) had normal BMI, 19(9.5%) were overweight and 7(3.5%) were found obese (Table-I).

Table I: Distribution by demographic characteristics (N=200)

Demographic characteristics	Frequency (Percentage)
Age group (in years)	
6-7	37(18.5)
7-8	45 (22.5)
8-9	43 (21.5)
9-10	40 (20.0)
10-11	35 (17.5)
Mean \pm SD	8.4 \pm 1.4 years
Sex	
Male	109 (54.5)
Female	91 (45.5)
BMI	
Underweight	51 (25.5)
Normal weight	123 (61.5)
Overweight	19 (9.5)
Obese	7 (3.5)

Normal blood pressure, pre-hypertension and hypertension were observed in 180(90%), 17(8.5%), and 3(1.5%) children respectively (Table-II). Urinalysis identified abnormalities in 9.5% of the participants. The most common finding was proteinuria, as found in 5.5% of the children (Table-III). Pyuria and hematuria were detected in 5.0% and 3.0% of children respectively (Table-IV).

Table-II: Distribution by blood pressure (N=200)

Blood pressure	Frequency	Percentage
Hypertension		
Isolated systolic hypertension	1	0.5
Isolated diastolic hypertension	-	-
Combined systolic and diastolic hypertension	2	1.0
Total hypertension	3	1.5
Prehypertension		
Isolated systolic pre-hypertension	4	2.0
Isolated diastolic pre-hypertension	-	-
Combined systolic and diastolic pre-hypertension	13	6.0
Total pre-hypertension	17	8.5
Normal blood pressure	180	90.0

Table-III: Distribution by findings of chemical urinalysis (n=46)

Findings of chemical urinalysis	Frequency	Percentage
Isolated leukocyturia	4	2.0
Isolated hematuria	2	1.0
Isolated proteinuria	7	3.5
Combined hematuria, proteinuria and leukocyturia	2	1.0
Combined proteinuria, leukocyturia and nitriuria	2	1.0
Combined hematuria, leukocyturia and nitriuria	2	1.0
Total proteinuria	11	5.5
Total hematuria	6	3.0
Total leukocyturia	10	5.0

Table-IV: Distribution by findings of abnormal microscopic urinalysis (n=16)

Findings of urine analysis	Frequency	Percentages
Pyuria (pus cell >5/HPF)	10	5.0
Hematuria (urinary RBC >5/HPF)	6	3.0

There was no significant difference in the overall prevalence of abnormalities among age groups, or between males and females ($p>0.05$). However, significant association was observed between urinary abnormalities and body mass index ($p<0.05$). A notably higher proportion of abnormalities was present in overweight and obese children compared to those having normal BMI (Table-V).

Table-V: Comparison of urine abnormalities by age, sex and BMI

Variables	Urine abnormalities	
	Present (n=19)	Absent (n=181)
	Frequency (Percentage)	Frequency (Percentage)
Age group (in years)		
6-7	-	37 (100.0)
7-8	1 (2.2)	44 (97.2)
7-9	4 (9.3)	39 (90.7)
9-10	7 (17.5)	5 (2.8)
10-11	7 (20.0)	28 (80.0)
p-value	>0.05	
Sex		
Male	12 (63.2)	97 (53.6)
Female	7 (36.8)	84 (46.4)
p-value	>0.05	
BMI		
Underweight	4 (21.1)	47 (26.0)
Normal	11 (57.9)	112 (61.8)
p-value	>0.05	
Overweight	2 (10.5)	17 (9.4)
Obese	2 (10.5)	5 (2.8)
p-value	<0.05	

p-values reached from Chi-square tests

Furthermore, a higher prevalence of proteinuria, pyuria, and hematuria were observed in male compared to female children ($p<0.05$) (Table-VI). Based on the urinalysis, asymptomatic renal disease was detected in 3.5% of the screened population.

This included urinary tract infection (2.0%), glomerulonephritis (1.0%), and renal stone (0.5%) (Table-VII).

Table-VI: Comparison of the frequencies of proteinuria, pyuria, and hematuria between male and female children (N=200)

Abnormal urinary findings	Male (n=109) Frequency (Percentage)	Female (n=91) Frequency (Percentage)
Proteinuria (urine albumin 1+ or more)	7 (6.4)	4 (4.4)
Pyuria (pus cell >5/HPF)	6 (5.5)	4 (4.4)
Hematuria (urinary RBC >5/HPF)	4 (3.7)	2 (2.2)
p-value	>0.05	

p-value reached from z-proportion test.

Table-VII: Distribution by asymptomatic renal diseases (N=200)

Asymptomatic renal disease	Frequency (Percentage)
Urinary tract infection (UTI)	4 (2.0)
Glomerulonephritis	2 (1.0)
Renal stone	1 (0.5)
No disease	193 (96.5)

Discussion

The key finding of the present study was that 9.5% of the children had abnormal urinary findings, with a presumptive diagnosis of renal disease made in 3.5% of the total cohort. This prevalence underscores a significant burden of silent renal pathology in this seemingly healthy population and highlights the critical role of non-invasive screening programs. The prevalence of urinary abnormalities (9.5%) identified in our study aligns with findings from similar school-based screenings in other regions. Studies in some regions reported abnormality rates ranging from 6.5% to 12.2%, confirming that a substantial portion of

school-aged children harbor detectable markers of renal dysfunction.^{14,15} Proteinuria, the most common abnormality in our study (5.5%), is a well-established predictor of chronic kidney disease progression.¹⁶ Its presence, even in isolation, warrants further investigation as it can signify glomerular injury. The rates of hematuria (3.0%) and pyuria (5.0%) are also consistent with other screening initiatives and can be indicative of conditions ranging from glomerulonephritis to occult urinary tract infections.¹⁷ A particularly notable finding was the significant increase in the prevalence of urinary abnormalities with advancing age. No cases were detected in the 6–7 years age group, while the rate rose sharply to 20.0% in the 10–11 years age group. This trend suggests that renal injury may accumulate over time or that certain conditions manifest later in childhood. It could also reflect prolonged exposure to environmental or infectious agents in an endemic setting.¹⁸ This finding emphasizes that screening programs should target a wide age range within schools to maximize detection. Furthermore, the strong statistical association between urinary abnormalities and hypertension is a cause for serious concern. All three children diagnosed with hypertension had abnormal urinalysis results. This aligns with the well-documented bidirectional relationship between renal disease and hypertension, where one can be both a cause and a consequence of the other.¹⁹ This synergy significantly accelerates cardiovascular morbidity, making early detection in childhood paramount.²⁰ The association with higher BMI categories further compounds this risk, reflecting the global trend of obesity-related glomerulopathy and its contribution to the CKD burden.²¹ While our study found no significant gender disparity in overall abnormality rates, the higher prevalence in males, though statistically insignificant, has been noted in

some studies for specific conditions like IgA nephropathy.²²

The strengths of this study include its community-based design and use of standardized methods. However, limitations must be acknowledged. The diagnosis of conditions like UTI and glomerulonephritis was presumptive, based on a single urinalysis without confirmatory culture or biopsy, potentially leading to overestimation.²³

Furthermore, the purposive sampling of two schools limits the generalizability of our findings to the entire country. This study demonstrates that urinalysis is an effective tool for uncovering a hidden burden of asymptomatic renal disease among school children in Bangladesh. The significant associations with age, hypertension, and BMI highlight identifiable risk factors. We recommend that health policymakers consider implementing large-scale, periodic school urinalysis screening programs as a cost-effective public health measure. Future studies should incorporate confirmatory diagnostic tests and longitudinal follow-up to determine the long-term outcomes of children with screen-detected abnormalities.

Conclusion

This study reveals a significant prevalence of asymptomatic urinary abnormalities among school children in Bangladesh, strongly associated with increasing age, hypertension, and higher BMI. Urinalysis proves to be a simple and effective screening tool for early detection of silent renal disease. The findings advocate for the implementation of routine school-based urinalysis screening programs. This public health initiative could enable timely intervention and potentially reduce the long-term burden of chronic kidney disease in the

population. Implementing routine school-based urinalysis screening is recommended for early detection of asymptomatic renal disease. Future studies should utilize confirmatory diagnostic tests and a larger, randomized sample to better understand the prevalence and long-term outcomes of screen-detected abnormalities.

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