

A Three Step Screening Protocol for Early Detection of Renal Abnormalities in Asymptomatic Indian School Children

Ashish Kumar Goyal¹, Pratik Akhiani², Vijay Nayak^{3*}

¹Military Hospital, Roorkee-247667, Uttarakhand, India

²Department of Physiology, Government Medical College, Khandwa, Madhya Pradesh, India

³Department of Anatomy, Government Medical College, Khandwa, Madhya Pradesh, India

ABSTRACT

Background & Objectives: Early screening of asymptomatic school children is of paramount importance in the early detection and treatment of silent renal diseases. The purpose of this study was to find out the prevalence of renal abnormalities in asymptomatic school going children using a three step screening protocol of dipstick, microscopy and renal ultrasound examination.

Methods: A total of 2722 school children (1638 boys and 1084 girls), aged 5–19 years, were screened for urinary abnormalities using dipstick, microscopy and renal ultrasound examination. 77 children found positive by dipstick, were screened by microscopy after 2-4 weeks and 44 children, found positive by microscopy, were screened by Renal Ultrasound Examination.

Results: Most common abnormality found by dipstick method and microscopy was isolated pyuria followed by isolated haematuria. Renal ultrasound detected 2 children (1 male, 1 female) with hydro ureter with hydronephrosis, 1 female child with small concretion in kidney, and 1 male child with generalised enhancement of echo texture in kidney.

Conclusion: Isolated pyuria, followed by isolated haematuria was the most common abnormalities. Such a three step screening protocol if routinely employed for early detection and treatment of renal abnormalities can decrease the incidence CKD and ESRD.

Key words: Hematuria, Pyuria, Ultrasonography, Urogenital abnormalities, Chronic kidney failure

HOW TO CITE THIS ARTICLE: Ashish Kumar Goyal, Pratik Akhiani, Vijay Nayak, A Three Step Screening Protocol for Early Detection of Renal Abnormalities in Asymptomatic Indian School Children, J Res Med Dent Sci, 2021, 9(8): 339-342

Corresponding author: Vijay Nayak
e-mail ✉: drvijayafmc@gmail.com
Received: 07/08/2021
Accepted: 23/08/2021

INTRODUCTION

The incidence of Chronic kidney disease (CKD) is on the rise worldwide, especially in paediatric population [1,2]. Early diagnosis and treatment of renal disorders is of utmost importance to prevent and in turn to reduce the disease burden of CKD in the community [3].

Screening for asymptomatic urinary abnormalities (AUA) is useful for early detection of renal diseases and asymptomatic infections, particularly among children [4]. Urinalysis, a simple and inexpensive test, remains to be a cornerstone in the diagnostic evaluation of kidney [5]. Many low cost screening programmes have been conducted using urinalysis for detection of kidney diseases [6,7].

Renal diseases are often accidentally discovered during routine urine analysis in asymptomatic healthy individuals [8]. With the aid of routine dipstick examinations early

symptoms of diseases of the kidneys and the urinary tract (Pyuria, hematuria and proteinuria) can be identified [9]. An abnormal urinary test may be the earliest warning of a significant renal pathology [10,11].

Mass urinary screening helps to determine the prevalence of renal diseases [12] and to improve the outcome in the population [13].

This study was carried out with the objective to find out renal abnormalities in asymptomatic school going children using urinalysis, microscopy and renal ultrasound examination.

MATERIALS AND METHODS

This cross sectional study was conducted at Military Hospital, Roorkee, Uttarakhand, India and included all asymptomatic school going children of 5-19 years of age (n=3100) studying at Kendriya Vidyalaya, Roorkee Cantonment, Roorkee. Children with diagnosed renal or any other systemic disorders, who were taking steroid or any other drug therapy, and whose parents denied to provide consent for participation were excluded from the study.

Age appropriate assent was obtained from children, while informed written consent was obtained from parents. Administrative consent was obtained from the school administration. All the procedures were in accordance with the ethical guidelines provided by the institutional ethics committee and the Declaration of Helsinki (2013 revision) [14]. The study commenced with establishment of a small lab in the school itself for the duration of study. Participants were instructed to void the first morning mid-stream urine sample into a 100 ml container, which was then examined by a trained lab technician. As the first screening test, a dipstick test (Multistix, by Nicholas Piramal) was performed on the unspun urine specimen with a reagent strip designed to react progressively producing color changes at given intervals.

The results were decided by visual colorimetry by comparison with a color chart provided by the manufacturer on the label of dipstick bottle. Urinalysis was considered abnormal if the following findings were detected by dipstick: 1. More than 5-10 RBC/ μ l; hematuria (Green dots on yellow test: intact erythrocytes; Uniform green coloration of test: free hemoglobin or hemolysed erythrocytes); 2. Trace or greater proteinuria (trace, 1+, 2+, 3+, 4+ correspond to 10 mg/dl, 30 mg/dl, 100 mg/dl, 300 mg/dl, and 1000 mg/dl respectively); 3. 1+ or greater glycosuria (1+, 2+, 3+ corresponds to 100 mg/dl, 300 mg/dl, and 1000 mg/dl respectively); 4. More than 25 WBC/ μ l; leukocyturia. Details of screening protocol are given in Figure 1. Statistical analysis was performed with the help of MS Excel and SPSS version 20. A p value lesser than 0.05 was taken to be statistically significant.

RESULTS

Out of 3100 children in the school, 378 children could not be tested, being absent from school on the day of testing (because they were ill or had moved, etc.) or unable to urinate when requested.

Thus, data for 2722 children (1638 boys and 1084 girls) were included in the statistical analysis.

Out of 77 children, the most common abnormality found by dipstick method was isolated pyuria (WBC in urine) (n=28, 36%) followed by isolated Haematuria (n=21, 27%) (Table 1).

By microscopy, out of 44 children, urine abnormalities were found in 70.5% females and 29.5% males. 47.7% were found to have isolated WBC in urine, 34% had isolated RBC in urine, 13.6% were having both RBC and WBC in urine and 4.5% were having only protein in urine (Table 2).

Renal ultrasound detected those 2 children (1 male, 1 female) had hydro ureter with hydronephrosis, 1 female child had small concretion in kidney, while 1 male child had generalised enhancement in echo texture in kidney (Table 3).

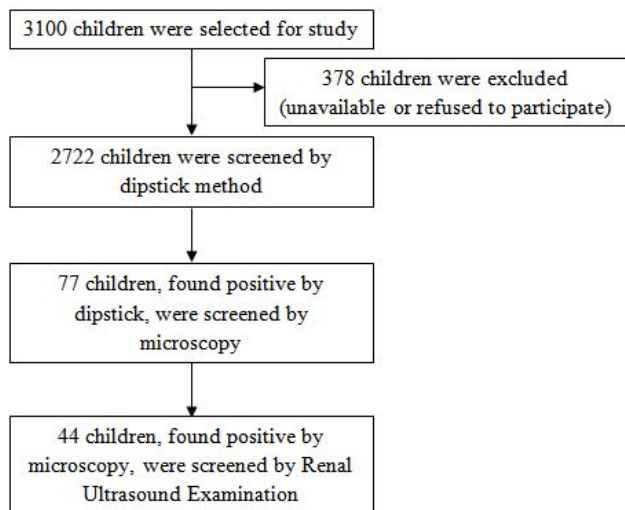


Figure 1: Screening protocol flowchart.

Table 1: Urine abnormalities by dipstick method (n=77).

Age group (in years)	Male	Female	Only WBC in Urine	Only RBC in Urine	RBC & WBC in Urine	Only Protein in Urine	Only Sugar in Urine	Protein & Sugar in Urine	Sugar & RBC in Urine
5-8	8	5	8	3	1	1	-	-	-
9-10	3	10	5	5	1	2	-	-	-

11-12	1	15	8	4	3	1	-	-	-
13 - 14	14	12	6	6	7	6	-	1	-
15 - 17	6	3	1	3	3	1	-	-	1
Total	32	45	28	21	15	11	Nil	1	1

Table 2: Urine abnormalities by microscopy (n=44).

Age group (in years)	Male	Female	Only WBC in Urine	Only RBC in Urine	RBC & WBC in Urine	Only Protein in Urine	Only Sugar in Urine	Protein & Sugar in Urine	Sugar & RBC in Urine
5-8	1	3	3	1	-	-	-	-	-
9-10	-	6	3	3	-	-	-	-	-
11-12	1	11	7	3	1	1	-	-	-
13-14	6	8	6	5	3	-	-	-	-
15-17	5	3	2	3	2	1	-	-	-
Total	13	31	21	15	6	2	Nil	Nil	Nil

Table 3: Kidney abnormalities detected by renal USG (n=4).

Age group (in years)	Male	Female	Hydroureter with Hydronephrosis	Small Concretion	Generalised Enhancement in Echotexture
5-10	-	-	-	-	-
11-17	2	2	2	1	1
Total	2	2	2	1	1

DISCUSSION

A significant number of disorders of kidney and urinary tract can remain asymptomatic for a long duration of time. Therefore, it is recommended to routinely conduct urinalysis screening programs for early diagnosis and management of renal damage. This strategy has been particularly important in reducing the gradually increasing burden of CKD in both developed and developing countries.

Findings of our study i.e. hematuria, proteinuria and pyuria in school going children were compared to other studies globally. Our finding of urinary abnormalities was nearly 2.9% of the studied group which was similar to the 2.5% and the 2.3% reported in Northern Iran and Malaysia respectively [15,16] higher than the 0.6% and the 0.72% reported in Tokyo and Egypt respectively [17,18] and lower than the 7.2% and the 9.6% reported in Bolivian and Nigerian studies respectively [19,20].

Pyuria was the most common urinary abnormality in our study. Whereas, other studies reported proteinuria as the commonest abnormality [18,20]. Hematuria prevalence was reported to be 0.21%, 0.36% and 0.46% in Malaysia, Egypt and Shanghai respectively [16,18,21] which is similar to our results of 0.22%. A higher prevalence 1.5% and 1.21% was reported from Nigerian and Xiamen cities respectively [20,22]. Bergstein et al reported hypercalciuria as the most common urinary abnormality

(in 16%) [23], which was followed by MPGN (membrano-proliferative glomerulonephritis) and PSGN (post-streptococcal glomerulonephritis) [24]. Vehaskari et al reported IgA nephropathy in two and Alport syndrome in one children by studying the renal biopsy of 22 children who had microscopic haematuria [25].

A study from Japan reported 7 cases of minor glomerular abnormalities, and 6 cases of IgA nephropathy among 220 children having microscopic haematuria [26]. These studies showed that microscopic asymptomatic hematuria might be benign but it can also be an important sign of underlying disease.

Proteinuria could be a temporary finding in normal children or an important manifestation of an underlying renal disease. It is an independent and important risk factor for ESRD (end stage renal disease). Therefore, asymptomatic proteinuria warrants further work up to detect and even prevent ESRD [27]. A study conducted in China reported that 2.87% children with urine abnormalities were detected by Ultrasound alone while 0.79% by both Ultrasound and urine alysis as compared to 0.15% and 0.07% respectively in our study [28].

A limitation of our study was that did not follow up the participants. Long-term follow up is important because children showing urinary abnormalities may develop full-blown kidney disease. The urinary dipstick method is

mainly sensitive for albumin while quantitative analysis methods can detect all renal proteins.

CONCLUSIONS

Our study assessed the prevalence of urinary abnormalities in school-aged children of India and isolated pyuria was found to be the most common urinary abnormality, followed by isolated haematuria. Such a three step screening protocol if routinely employed for early detection and treatment of renal abnormalities can decrease the incidence CKD and ESRD.

REFERENCES

- Shalaby MA, Abd El Hameed AE, Affifi WE, et al. Screening for urine abnormalities among school children in Qalubya. *Geget* 2019; 14:75-81.
- <https://emedicine.medscape.com/article/984358>.
- Parakh P, Bhatta NK, Mishra OP, et al. Urinary screening for detection of renal abnormalities in asymptomatic school children. *Nephrol Mon* 2012; 4:551-555.
- Nour MO, Mansour AE, Ghandour AA, et al. Prevalence of asymptomatic urinary abnormalities among primary school children in damietta governorate. *Umm Al-Qura Univ Med J* 2013; 4:1-8.
- Alharthi AA, Taha AA, Edrees AE, et al. Screening for urine abnormalities among preschool children in western Saudi Arabia. *Saudi Med J* 2014; 35:1477.
- Marquette GP, Dillard T, Bietla S, et al. The validity of the leukocyte esterase reagent test strip in detecting significant leukocyturia. *Am J Obstet Gynecol* 1985; 153:888-889.
- Arm JP, Peile EB, Rainford DJ, et al. Significance of dipstick hematuria: Correlation with microscopy of the urine. *Br J Urol* 1986; 58:211-217.
- Ahmed Z, Lee J. Asymptomatic urinary abnormalities. Hematuria and proteinuria. *Med Clin North Am* 1997; 81:641-52.
- Longo DL, Kasper DL, Jameson JL, et al. Harrison's principles of internal medicine. 18th Edn. New Delhi: McGraw Hill Medical Publishing Division, 2011.
- Abitbol C, Zilleruelo G, Freundlich M. Quantitation of proteinuria with urine protein/creatinine ratios and random testing with dipsticks in children. *J Pediatr* 1990; 116: 243-7.
- Bard RH: The significance of asymptomatic hematuria in women and its economic implications: A ten-year study. *Arch Intern Med* 1988; 148:2629-32.
- Kitagawa T. Lessons learned from the Japanese nephritis screening study. *Pediatr Nephrol.* 1988; 2:256-263.
- Park YH, Choi JY, Chung HS, et al. Hematuria and proteinuria in a mass school urine screening test. *Pediatr Nephrol* 2005; 20:1126-1130.
- World medical association declaration of helsinki. Ethical principles for medical research involving human subjects. *JAMA* 2013; 310:2191-2194.
- Badeli H, Heidarzadeh A, Ahmadian M. Prevalence of hematuria and proteinuria in healthy 4 to 6 year old children in daycare centers of Rasht (Northern Iran). *Iran J Pediatr* 2009; 19:169-172.
- Zainal D, Baba A, Mustafa BE. Screening proteinuria and hematuria in Malaysian children. *Southeast Asian J Trop Med Public Health* 1995; 26:785-788.
- Murakami M, Yamamoto H, Ueda Y, et al Urinary screening of elementary and junior high-school children over a 13 year period in Tokyo. *Pediatr Nephrol* 1991; 5:50-53.
- Bakr A, Sarhan A, Hammad A, et al. Asymptomatic urinary abnormalities among primary school children in Egypt. *World J Pediatr* 2007; 3:214-217.
- Plata R, Silva C, Yahuita J, et al. The first clinical and epidemiological programme on renal disease in Bolivia: A model for prevention and early diagnosis of renal diseases in the developing countries. *Nephrol Dial Transplant* 1998; 13:3034-3036.
- Akor F, Okolo S, Agaba E, et al. Urine examination findings in apparently healthy new school entrants in Jos, Nigeria. *SA J Child Health* 2009; 3:60-63.
- Rao J, Zhou L, Shen Q, et al. School urinalysis screening in Shanghai. *World J Pediatr* 2006; 3:195-198.
- Tong S, Gui-lan P, Hui-fen Z, et al. Urine routine screening of 34455 school children in Xiamen city. *J Child Health Care* 2009; 1.
- Bergstein J, Leiser J, Andreoli S. The clinical significance of asymptomatic gross and microscopic hematuria in children. *Arch Pediatr Adolesc Med* 2005; 159:353-355.
- Stapleton F. Asymptomatic microscopic hematuria. *Arch Pediatr Adolesc Med* 2005; 159:398-399.
- Vehaskari VM, Rapola J, Koskimies O, et al. Microscopic hematuria in schoolchildren: epidemiology and clinicopathologic evaluation. *J Pediatr* 1979; 95:676-684.
- Murakami M, Hayakawa M, Yanagihara T, et al. Proteinuria screening for children. *Kidney Int* 2005; 68:S23-27.
- Hanif R, Ally S, Jalal-ud-din, et al. Effectiveness of routine urinalysis of patients attending rural health care centers in abbottabad. *J Ayub Med Coll Abbottabad* 2006; 18:63-64.
- Yang H, Wang Q, Luo J et al. Ultrasound of urinary screening in 14256 asymptomatic children in China. *Nephrology* 2010; 15:362-367.