



Original Research Article

Proteinuria among school children aged 8-16 years in rural area of Karnataka

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ABSTRACT

Chronic kidney disease (CKD) in children is a devastating illness, and the mortality rate of the children is high and majority of them present at the later stages of disease. Early diagnosis of renal diseases with effective preventive and interventional strategies will help in reducing the burden of the disease. Urine protein estimation is one of the simplest, least expensive method to detect urinary abnormalities which may suggest the presence of renal disease. Presence of proteins in urine is termed proteinuria and its presence for more than 3 occasions is termed persistent proteinuria (PP).

The present study is a cross-sectional one and was planned to determine prevalence of persistent proteinuria in 500 healthy school children aged between 8-16 years. Out of 500 students, proteinuria was positive in 4.4% of the students in the first visit and persistent in 2.4%. Proteinuria was positive and persistent in 1.8% of girls and 0.6% of boys.

Proteinuria is an early marker of kidney disease. It is important to identify these cases to detect renal disease if any so that remedial steps can be taken to prevent the associated morbidity. Children with persistent proteinuria should be subjected to follow-up and further workup to identify the cause.

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1. Introduction

Chronic kidney disease (CKD) in children is a devastating illness, and the mortality rate of the children is high.¹ It is depressing to note that in India, most of the children (58%) with CKD do not receive medical attention, as many of them are in end stage renal disease at the time of presentation.² One of the most common cause of CKD in children are obstructive or reflux nephropathy leading to chronic glomerulonephritis (CGN).³ Early diagnosis of renal diseases and effective preventive and interventional strategies will help reduce the burden of disease due to CKD.⁴ With screening methods chances of early detection and management of CKD will improve.

Among the several methods of screening for CKD, urine protein estimation is one of the simplest, least expensive method to detect urinary abnormalities which

may suggest the presence of chronic kidney disease.⁴ Presence of proteins in urine is termed as proteinuria. When the proteinuria is detected for more than two occasions, it is called persistent proteinuria (PP), which portends the need for further evaluation.⁵

Many countries have been conducting routine screening of school children for the presence of proteinuria since many decades. In Japan, where school children are screened for urine proteins, the incidence of end stage renal disease (ESRD) is significantly low as compared to America where no such screening is performed.⁶ However, in India this screening has not been adopted yet. Studies document a prevalence of persistent proteinuria range from 0.6% to 6.3% worldwide.⁵

However, the data regarding its prevalence in India is scarce. In studies done in Kashmir and in Jaipur, the prevalence of persistent proteinuria was 2.7% and 2.5% respectively.^{5,7} There is scarcity of data on prevalence of PP in children in south Indian population.

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The present study was planned to determine prevalence of persistent proteinuria in school children aged between 8-16 years. This screening for urine proteins will help identify those children who need further workup to determine the etiology and adopt necessary preventive or therapeutic interventions.

2. Materials and Methods

The cross-sectional study was conducted in three schools. The students were selected by using stratified random sampling method and 500 students were selected.

Healthy school children aged between 8 and 16 years and who were willing to participate in the study were included in the study. Students on any medication and those with history of fever, dysuria, hematuria and known calculi were excluded from the study.

2.1. Definition of variables

Persistent proteinuria was defined as positive test for protein on two occasions three weeks apart. Urinary tract infection (UTI) is a collective term for infections that involve any part of the urinary tract.

Hypertension (HT) in children was considered if average SBP and/or DBP that was greater than or equal to the 95th percentile for that particular sex, age and height on three or more occasions.

Body mass index (BMI) was calculated by formula weight in (kg)/height (m²). BMI < 25 was considered normal weight, BMI > 25 was considered overweight, BMI > 30 was considered as obese.

2.2. Method of measuring blood pressure in children

Auscultatory method, using a sphygmomanometer. Three measurements were taken on different occasions. The cuff used was appropriate size for the children's upper arm. The width of the cuff used was 40% of the arm circumference at a point midway between the olecranon and the acromion. The children were calm and relaxed, seated with their right arm resting at heart level. Systolic blood pressure is defined by the first Korotkoff sound (K1) whereas diastolic blood pressure coincides with the disappearance of the Korotkoff sound (K5).

Institution ethical committee (IEC) clearance was obtained from the Institutional ethical committee.

A prior permission for conducting the study was obtained from the block education officer, the institution administrators and parents. Assent was obtained from the students >7 years of age. If the age exceeds more than ≥6 months, the next higher age shall be considered. Written informed consent from the parents or guardians of the student was obtained after briefing the research protocol to them in a meeting in presence of principal investigator.

A semi structured questionnaire was administered to the students to get filled by parents at home. A complete history including age, sex, type of school as private and government, family history of diabetes mellitus and family history of hypertension was included in the questionnaire. Positive history was confirmed by telephonic conversation with parents. The study was conducted in free or physical activity periods.

Prior validated and standard tools were used which included electronic weighing machine, non-stretchable tape and mercury sphygmomanometer properly calibrated and of appropriate cuff size.

Morning urine sample was collected for avoiding effect of exercise. Urine samples were collected in clean wide mouth bottles. All students were advised to collect midstream clean sample of urine under strict aseptic precautions. Dipstick test was performed by the technician. For the positive results, test was repeated after a duration of three weeks with same dipstick brand. Height was measured with holding head straight and body touching the wall. Weight was measured without shoes and in school uniform. Blood pressure was recorded in sitting position with a mercury sphygmomanometer using standard technique. At one setting BP was recorded three times in the right upper arm with rest of 10 minutes in between. Waist circumference was recorded at the level of umbilicus. For female students a female attendant was deputed. Prevalence of proteinuria was documented. Association with gender, hypertension, family history of diabetes mellitus and family history of hypertension and BMI was assessed.

Dipstick method:⁵ This test detects protein reaction between albumin and tetrabromophenol blue which changes the dipstick colour from yellow to green. The colour was compared with the label on the box.

Grade scale: If Traces is the grade then amount of protein excreted is 10-20mg/dl. If the grade is 1+ then amount of protein excreted is 30mg/dl. If the grade is 2+ then amount of protein excreted is 100mg/dl. If the grade is 3+ then amount of protein excreted is 300mg/dl. If the grade is 4+ then amount of protein excreted is >2000mg/dl.

2.3. Statistical analysis

Data was expressed as mean +/- standard deviation, proportions and percentages. Correlation of proteinuria with categorical variables, like gender, hypertension, family history of diabetes mellitus and family history of hypertension. Univariate and multivariate analysis was done to analyse the data using SPSS 18.0. (Statistical Package for Scientific Studies) for Windows. Association between various variables was done using Fisher's exact probability test. p value less than 0.05 was considered statistically significant.

3. Observation and Results

The present study was conducted in a rural setup comprising of 500 school students in the age group of 8-16 years and mean age was 13.45 ± 2.0 .

Maximum number of students who contributed to the study were in the age group of 14(26.6%) and 15(28.6%) years (Table 1).

There was no statistically significant association between age and proteinuria. Maximum number of cases of persistent proteinuria were in the age group of 13 years (5/12) 41.6%.

Out of 500 students 243 (48.6%) were girls and 257 (51.4%) were boys. Number of girls and boys contributing to the study were almost equal

Out of 500 students, proteinuria was positive and persistent in 1.8% of girls and 0.6% of boys (Table 2). Proteinuria was significantly more in girls compared to boys.

4.4% of the students were positive for proteinuria in the first visit and 95.6% of the subjects were negative for proteinuria. 2.4% of the students were positive for proteinuria on the second occasion and 97.6% of the subjects were negative for proteinuria.

The association between hypertension and persistent proteinuria was “statistically” significant with the p value of 0.024. However we cannot draw inference between this association as we could find only one case of hypertension in our study.

1.4% of the subjects who were underweight had proteinuria and 1% of subjects who were normal had proteinuria. None of the subjects who were overweight and obese had proteinuria. There was no statistically significant relationship between proteinuria and BMI.

The family history of DM was found in 0.2% of subjects with proteinuria and 19.6% of subjects without proteinuria (Table 5). This association was not statistically significant.

The family history of HT was found in 0.2% of subjects with proteinuria and 3.6% of subjects without proteinuria (Table 6).

There was no statistically significant relationship between family history of DM and family history of HT with proteinuria.

4. Discussion

Chronic kidney disease (CKD) is an insidious and irreversible condition that eventually progress to end stage renal failure. It is an important cause of morbidity and mortality of children worldwide.⁸ Proteinuria, an early marker of kidney damage, is an important independent risk factor for kidney disease progression.⁹ Majority of the children with CKD present at end stage renal disease.²

Early identification of renal diseases in children can reduce the burden of disease due to CKD and reduce morbidity and mortality associated with it by doing routine

screening for proteinuria in school children and by adopting early preventive strategies.⁴

The prevalence of persistent proteinuria in school children range from 0.6% to 6.3% worldwide.⁵ Park YH et al. in their study involving 1044 school children observed persistent proteinuria in 1.9% and transient proteinuria in 26.4%.⁴ Chronic renal failure in children usually carries a poor prognosis due to delayed diagnosis and hence Gulati S et al. recommended early screening for proteinuria is important for planning proper treatment.²

Proteinuria shows regional variation among different countries like lower prevalence rate (0.12% to 3.56%) from Egypt, Iran, Malaysia and Japan. In contrast, a higher prevalence (9.6% to 30.3%) from other regions of the world.¹⁰ In India, higher prevalence of proteinuria has been observed in rural school children as compared to urban areas.⁵ Low literacy, poor access to health care facility etc were proposed as the causal factors for this difference. Malla HA et al. in their study of 2068 children for proteinuria by dipstick method, observed the prevalence of proteinuria at first time was 6.2% & which persisted in 2.17% of cases. They did not find any significant association of proteinuria with gender, Body mass index (BMI) and hypertension.⁵

Chang Chein et al in their large retrospective study involving 37,465 children found proteinuria to be higher among girls as compared to boys. The prevalence of persistent proteinuria in their study was 2.3%.¹¹ Vinoth PL et al. in their study involving 1000 school children between 6-18 years of age observed proteinuria in 4.3%. They found proteinuria was more common in boys as compared to girls. They observed that there was a significant association of proteinuria with hypertension. They recommended that urine screening is important in identification of occult renal disease in asymptomatic patients.¹⁰ There are not much studies to find association between BMI and proteinuria. However, Malla et al observed no association between BMI and proteinuria.

Trihono PP et al. in their study involving 449 asymptomatic school children observed transient proteinuria in 4.5% and persistent proteinuria in 1.4%. Though the prevalence of low, the authors recommended long term follow-up in these cases due to significant risk of renal damage.¹²

Adesola A et al in their study involving 894 school children in rural area observed proteinuria for first time in 7.7% and persistent proteinuria in 3.8%. They observed that infection and infestations were the most common cause for proteinuria.¹³ There are few studies documenting the prevalence of proteinuria in children in the rural setup in India. Similarly, the association between proteinuria and hypertension has not been well established.

In the present study 22 children were detected to have proteinuria by single dipstick method out of 500 children, with a prevalence of 4.4%. On a second dipstick

Table 1: Association between proteinuria and age

Age	Persistent Proteinuria				Total	
	Yes Number	%	No Number	%	Number	%
8	0	0	18	3.6	18	3.6
9	1	0.2	33	6.6	34	6.8
10	0	0	2	0.4	2	0.4
11	0	0	16	3.2	16	3.2
12	0	0	25	5.0	25	5.0
13	5	1	92	18.4	97	19.4
14	4	0.8	129	25.8	133	26.6
15	2	0.4	141	28.2	143	28.6
16	0	0	32	6.4	32	6.4
Total	12	2.4	488	97.6	500	100.0

Fisher's exact test, p= 0.835

Table 2: Association between persistent proteinuria and Gender

Proteinuria	Gender		Total
	Girls	Boys	
Yes	9(1.8%)	3(0.6%)	12(2.4%)
No	234(46.8%)	254(50.8%)	488(97.6%)
Total	243(48.6%)	257(51.4%)	500(100.0%)

Fisher's exact Test, p=0.081

Table 3: Prevalence of proteinuria for the first time and persistent proteinuria

	Proteinuria during 1 st visit	Persistent proteinuria
Yes	22 (4.4%)	12 (2.4%)
No	478(95.6%)	488 (97.6%)
Total	500 (100%)	500 (100%)

Table 4: Association between persistent proteinuria and Hypertension

Proteinuria	Hypertension		Total
	Yes	No	
Yes	1(0.2)	11(2.2)	12(2.4)
No	0(0.0)	488(97.6)	488(97.6)
Total	1(0.2)	499(99.8)	500(100.0)

Fisher's exact Test, p=0.024

Table 5: Association between proteinuria and family history of diabetes mellitus

Proteinuria	Family History of Diabetes Mellitus		Total
	Yes	No	
Yes	2(0.4)	10(2.0)	12(2.4)
No	36(7.2)	452(90.4)	488(97.6)
Total	38(7.6)	462(92.4)	500(100.0)

Fisher's exact Test, p=0.230

Table 6: Association between proteinuria and family history of hypertension

Proteinuria	Family History of Hypertension		Total
	Yes	No	
Yes	1(0.2)	11(2.2)	12(2.4)
No	18(3.6)	470(94.0)	488(97.6)
Total	19(3.8)	481(96.2)	500(100.0)

Fisher's exact Test, p=0.375

examination conducted after the duration of three weeks' proteinuria persisted in 12 children with a prevalence of 2.4%.

Maximum number of children in the present study were 15 years old accounting to 28.6%. Similar findings were reported by Malla et al.⁵

In the present study proteinuria were more in girls (1.8%) as compared to boys (0.6%). Similar findings were observed by Malla HA et al.⁵ and Chang Chen C et al.¹¹ However in contrast, Vinoth et al¹⁰ and Lin et al. found proteinuria in more males than females.¹⁰

In the present study, there was no relationship between BMI and proteinuria. Similar findings were documented by Malla HA et al.⁵ Contrary to this, Toto RD et al¹¹ in their study found significant association of BMI and proteinuria.

In the present study, a correlation between hypertension and proteinuria though it was found to be statistically significant with a p value of 0.024 we could not draw inference between this association as we could find only one case of hypertension.

The present observational study shows there was no statistically significant correlation between family history of hypertension and diabetes mellitus with proteinuria. However, there is no well documented literature suggesting association of family history of hypertension with proteinuria.

5. Conclusion

Prevalence of Proteinuria in the present study which was persistent is 2.4%. Proteinuria is an early marker of kidney disease. It is important to identify these cases to detect renal disease if any so that remedial steps can be taken to prevent the associated morbidity.

6. Suggestion

Children with persistent proteinuria should be subjected to follow-up and further workup to identify the cause.

Routine screening for proteinuria in school children should be a part of basic medical health check-up so that appropriate remedial measures can be taken to prevent the development of chronic kidney disease.

7. Source of Funding

None.

8. Conflict of Interest

The authors declare that there is no conflict of interest.

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