Original Articles

Assessment of Proteinuria in Nephrotic Syndrome in Children by Using Spot Urinary Protein/Creatinine Ratio

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Abstract

Background: *Quantification of proteinuria is usually predicted upon 24-hour urine collection. Multiple factors influence urine collection and the rate of protein and creatinine excretion. A spot urine protein-creatinine (P-C) ratio has been shown over the years to be a reliable alternative to the 24-hour collection for detection and follow up of proteinuria. The objective of the study was to evaluate the accuracy of urine protein creatinine ratio (UP/UC) in a spot sample for quantitative measurement of proteinuria in comparison with 24 hours urinary protein excretion in children of nephrotic syndrome having normal Glomerular Filtration Rate (GFR).*

Methodology: *This was a prospective study conducted in the department of paediatrics, Sir Salimullah Medical College & Mitford Hospital Dhaka over a period of six months from January 2003. Fifty cases of Nephrotic syndrome were included who were on initial attack and relapse cases noted down into the proforma with respect to history, examination and investigation. All the patients were advised regarding 24 hours urine collection. They were asked to give a 24 hours urine sample starting at 9.00 am for total protein excretion rate. A spot urine sample was obtained and urine protein/creatinine ratio was calculated. The data was analyzed by linear regression and by calculating the correlation coefficient between urinary protein/ creatinine ratio and 24-hour urinary protein.*

Results: *Sample size was fifty. Urine total protein in a timed 24-hour sample of nephrotic syndrome patients was in the range of 300-3150mg/m^2/hour with the mean value of 1725 mg/m^2/hour. While as U(Pr/Cr) ratio ranged from 3.1-27.5 with the mean value of 15.2. A significant correlation was found between timed 24-hour urinary protein and UP/UC ratio (r=0.622, p=<.001.)*

Conclusions: *Spot urine protein-creatinine ratio is highly reliable and rapid test for quantification of proteinuria in children with nephrotic syndrome.*

Keywords: *Spot urine, 24-hour urine, proteinuria, protein-creatinine ratio, nephrotic syndrome, children.*

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Introduction:

Diagnosis of nephrotic syndrome requires the presence of edema, massive proteinuria (>40 mg/m²/hour) or a urine protein/creatinine ratio (>2.0 mg/mg) and hypoalbuminemia (<2.5 gm/dl)[1,2].The annual incidence is 2-3 cases per 100000 children per year and higher in underdeveloped countries resulting predominantly from malaria[3] . Assessment

of urinary protein excretion is not only diagnostic but also has prognostic value in monitoring of nephrotic syndrome[4]. Traditionally urinary protein assessments has been done in 24 hours urine collection specimens but this approach is time consuming, cumbersome, and imprecise[5]. An alternative approach has been advocated by some researchers avoiding 24 hours' collection. This is the measurement of protein/ creatinine ratio in a random urine sample[6]. This approach is based on the fact that in the presence of a stable glomerular filtration rate, urinary creatinine excretion has been reported to be fairly constant in a given individual[7].So this study was done to evaluate the UP/UC ratio as a rapid and reliable test for the estimation of various ranges of proteinuria and thus its usefulness in the diagnosis of nephrotic syndrome in children The objective of the study was to evaluate the accuracy of urine protein creatinine ratio (UP/ UC) in a spot sample for quantitative measurement of proteinuria in comparison with 24 hours urinary protein excretion in children of nephrotic syndrome .

Methodology
It is a prospective study done by purposive sampling in Sir Salimullah Medical College & Mitford Hospital Dhaka on January - July 2003.Sample size was 50 in number. Inclusion criteria- patients fulfilling the criteria of nephrotic syndrome & having normal renal functions. Exclusion criteria were age <1year and patients having extremely low urine output. (<100ml/ 24hrs). All patient were provided written informed consent for this study. Total 50 patients having various degree of proteinuria were selected purposively. Careful history, thorough physical examinations was done. Twenty four hour urinary total protein along with spot urinary protein/ creatinine ratio of each patient were estimated. Urinary total protein excretion was quantified by the Esbach's Albuminometer. Urinary Creatinine measurement was done by using an auto analyzer (Astra-8, Beckman Instruments, Brea, CA). Statistical analysis :Pearson's correlation coefficient was done in between urinary protein/ creatinine ratio and 24-hour urinary protein . The Ethical committee of Sir Salimullah Medical College has approved the study.

Results:
During the study 50 patients were included; cases were noted down into the proforma with respect to history, examination and investigation, from whom 50 samples were collected. This included a 24-hour urine sample followed by the next voided spot sample. The protein/creatinine ratio was calculated on the spot sample. The results were analyzed as

follows: Out of 50 cases, 7cases were in the age group of <3 years, 39 cases in <3-9 years and 4 cases were >9 years (Table-2). Among 50 cases, 34 cases were male and remaining 16 were females. So, Male: female ratio was 2.1:1(Figure-1). Among these cases, 38 patients presented for the first time while remaining 12 cases were of relapse The most common symptom was puffiness of face (100%), oliguria-100%, ascites (66.66%) and RTI (32.66%), UTI (32%) (Table-I). Various investigation profiles are noted in Table-III. All cases showed urine protein to be >3+. In present study, the range of timed 24 hours urine total protein was 300-3150mg/m^2/hour with the mean value of 1725 mg/m^2/hour. While as U(Pr/Cr) ratio ranged from 3.1-27.5 with the mean value of 15.2. Urine protein/creatinine ratio (UP/UC) (mg/mg). Linear regression of spot urine protein creatinine ratio against 24-hour urinary total protein shown in (Figure-2) (Correlation coefficient: r = 0.622, P <0.01.
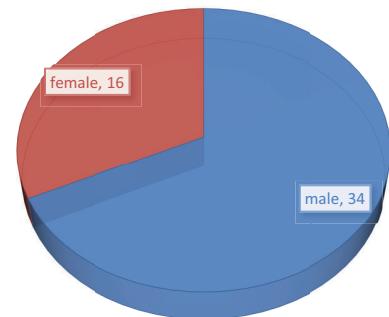

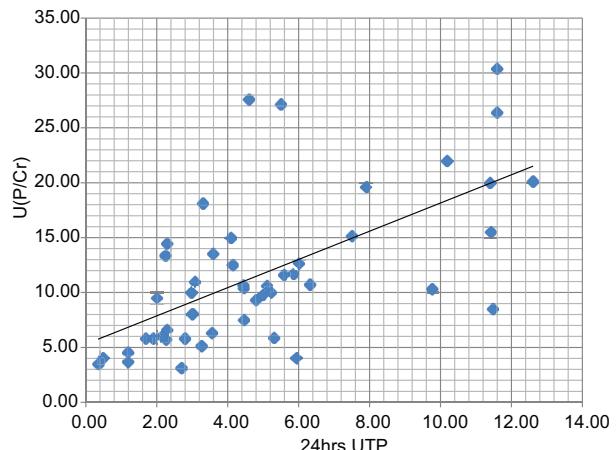**Fig.-1:** *Distribution of patients in different Sexes (N=50)*

Fig.-2: *Pearson's correlation shows: strong positive correlation with Spot urinary protein creatinine ratio with 24 hrs UTP.*

50 cases of 24hrs UTP plotted along X-axis and spot urinary protein creatinine ratios U(P/Cr) was plotted in Y axis. Positive correlation line was drawn by using this values.

Table-I

Distribution of patients in different clinical presentations (N=50)

Clinical parameters	Number of patients
Puffiness	50
Oliguria	50
Ascites	33
URTI	16
UTI	12
Hematuria	6
Pleural effusion	6
Peritonitis	5
Hypertension	4
Diarrhea	3
CCF	2

Table-II

Distribution of patients in different ages (N=50)

Age	<3 years	3-9 years	>9 years
Number of Patients	7	39	4

Table-III

Biochemical profile of the study subjects (N=50)

Investigation	Mean (+ SD)
Serum Albumin	17.65 (+5.78) gm/L
Serum Globulin	32.29 (+6.2) gm/L
Serum Cholesterol	10.13(+2.9) mmol/L
Serum creatinine (umol/L)	74 (+17.5) umol /L

Discussion

This study on evaluating the utility of spot urine protein/creatinine ratio in the diagnosis inpatients of nephrotic syndrome in children was conducted in the department of paediatrics, Sir Salimullah Medical College & Mitford Hospital Dhaka on January - July 2003.A total of 50 cases of nephrotic syndrome were seen age ranged from 1 year to 12 years. The mean age in the present study was 6.5 years. Similar observations were made by Chahar OP et al[8] and Shastri NG et al[9]. In the present study 20% of cases showed presence of hematuria. Similar observations were made by Siegal NJ et al.[10]. In the present study, correlation coefficient obtained was r=0.622 and value obtained was statistically significant (P <0.001). The correlation coefficient obtained in the other studies were highly significant. like Iyer RS et al[11] (r=.86), Wahbeh AM et al.[12] (r=.83), Siwach SB et al.[13] (r=.88). For the diagnosis of nephrotic syndrome 24hrs UTP is still being used widely and popularly which is a lengthy cumbersome procedure. For all studied cases 24hrs UTP and spot urine protein/ creatinine ratio U(P/Cr) have been done to make a comparison and correlation. Results of the study show strong correlation between 24hrs UTP and spot urine protein/creatinine ratio. So, spot urinary protein/ creatinine ratio can be used as a diagnostic tool of nephrotic range proteinuria as 24 hrs. UTP.

Conclusion

Thus, we conclude that spot urine protein-creatinine ratio is highly reliable and rapid test for quantification of nephrotic range proteinuria in children. It reflects the amount of protein in a 24-hour collection. Thus, it avoids all the drawbacks which are associated with time collection method.

Disclaimer : It is a dissertation for the partial fulfilment of appearing in FCPS paediatric examination.

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