



ASSESSMENT OF PROTEINURIA USING SPOT URINE PROTEIN CREATININE RATIO IN CHILDREN WITH NEPHROTIC SYNDROME IN DMCH

Paediatrics

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ABSTRACT

Objectives: The objective of the study were to determine Assessment of proteinuria using spot urine protein creatinine ratio in children with nephrotic syndrome in DMCH.

Materials and methods: Data were collected from the children admitted in Darbhanga Medical Hospital, Laheriasarai. Urine sample were collected from the each children at the time of admission.

Results: Out of 75 children, the clinical symptoms that children were having puffiness of the face 100% (75/75), oliguria 100% (75/75), RTI 66.7% (50/75), ascites 33.3% (25/75), UTI 33.3% (25/75), Hematuria 13.3% (10/75), pleural effusion 20% (15/75), peritonitis 13.3% (10/75), hypertension 13.3% (10/75), diarrhoea 26.7% (20/75), CCF 20% (15/75). There is Linear regression of spot urine protein creatinine ratio (UPr/UCr) against 24-hour urinary total protein (UTP).

Conclusion: Spot urine protein-creatinine ratio is highly reliable and rapid test for quantification of nephrotic range proteinuria in children.

KEYWORDS

Nephrotic syndrome, urine protein creatinine ratio, urinary total protein.

INTRODUCTION

Nephrotic syndrome is one of the most common kidney diseases in children and adults, and is characterised by massive proteinuria, oedema and hypoalbuminaemia.¹ The annual incidence and prevalence of nephrotic syndrome in children are 2–7 new cases and 16 cases per 100,000 children, respectively, and in adults the yearly incidence is three new cases per 100,000 adults.^{2,3} Nephrotic syndrome is characterised by generalised oedema, massive proteinuria and hypoalbuminaemia. Although, it has been described in all races, South Asian children are thought to have the highest incidence. The proteinuria and low albumin levels in nephrotic syndrome is due to increase in permeability of glomerular capillary wall due to podocytes foot process effacement.⁴

The quality of protein (mainly albumin) excreted in urine can be assessed by using dipstick test.⁵ Visual changes in the colour of the dipstick are a semi-quantitative measure of increasing urinary protein concentration. The dipstick is reported as negative, trace (10–20 g/dL), 1+ (30–99 mg/dL), 2+ (100–299 mg/dL), 3+ (300–999 mg/dL), and 4+ (>1000 mg/dL). False-negative test results can occur in patients with dilute urine (specific gravity <1.005) or in disease states in which the predominant urinary protein is not albumin. More appropriate quantitative test for proteinuria is spot urine protein: creatinine ratio (UPr: UCr). This ratio is calculated by dividing the UPr (mg/dL) concentration by the UCr (mg/dL) concentration and is best performed on a first morning voided urine specimen to eliminate the possibility of orthostatic (postural) proteinuria. Ratios <0.5 in children <2 years of age and <0.2 in children ≥2 years of age suggest normal protein excretion. A ratio >2 suggests nephrotic-range proteinuria. UPr: UCr ratios have been shown to have a high correlation with protein excretion determinations in timed urine collection (24 hours). A reasonable upper limit of normal protein excretion in healthy children is 150 mg/24 hr (0.15 g/24 hr). More specifically, normal protein excretion in children is defined as <4 mg/m²/hr; abnormal proteinuria is defined as 4–40 mg/m²/hr; and nephrotic range proteinuria is defined as >40 mg/m².^{6,7,8}

Aim of the study is the Assessment of proteinuria using spot urine protein creatinine ratio in children with nephrotic syndrome.

MATERIALS AND METHODS

The study was carried out in the Department of Paediatrics, Darbhanga Medical Hospital, Laheriasarai. A total of 75 children were selected from the hospital. Permission from the hospital authority and ethical committee was taken before conducting this study.

Children fulfilling the criteria of nephrotic syndrome & having normal renal functions and having various degree of proteinuria were included in the study. A detailed informed consent was taken from the mothers whose children were included in the study.

Children whose age were <1 year and children having extremely low urine output (<100ml/24hrs) were excluded from the study.

Careful history, thorough physical examinations was done for each children that were included in the study. Twenty four hour urinary total protein along with spot urinary protein/creatinine ratio of each children 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. A p-value of <0.05 was considered as statistically significant.

RESULTS

A total of 120 children were screened during the study, out of which 75 children were included in the study. Overall 45 children were excluded from the study.

Children that were included in the study were noted down into the proforma with respect to history, examination and investigation, and 24 hour urine sample followed by next void spot urine sample were collected and the urine protein creatinine ratio was calculated on the spot sample.

Out of 75 children that were included in the study, 11 children were in the age group of < 3 years, 58 children were in the age group of 3–9 years and 6 children were in the age group of > 9 years.

Out of 75 children that were included in the study, 52 children were male and 23 children were female. Male female ratio was 2.3:1.

Out of 75 children that were included in the study, 54 children presented for the first time while 21 children were relapse.

The clinical symptoms that children were having puffiness of the face 100% (75/75), oliguria 100% (75/75), RTI 66.7% (50/75), ascites 33.3% (25/75), UTI 33.3% (25/75), Hematuria 13.3% (10/75), pleural effusion 20% (15/75), peritonitis 13.3% (10/75), hypertension 13.3% (10/75), diarrhoea 26.7% (20/75), CCF 20% (15/75). All children had urine protein >3+. **Table 1**

In the present study, the range of timed 24 hours urine total protein was 300–3150 mg/m²/hour with the mean value of 1725 mg/m²/hour. While as Urine protein/creatinine ratio (UPr/UCr) ratio ranged from 3.1–27.5 with the mean value of 15.2 (mg/mg).

There is Linear regression of spot urine protein creatinine ratio (UPr/UCr) against 24-hour urinary total protein (UTP). (Correlation coefficient: $r = 0.622$, P -value < 0.001). **Fig 1**

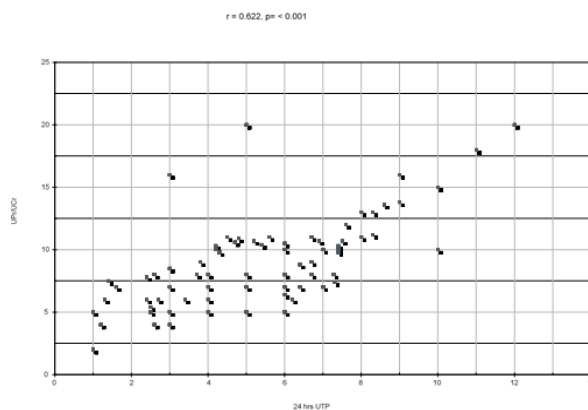


Fig 1: Pearson's correlation between urine protein creatinine ratio (UPr/UCr) and 24 hrs urinary total protein(UTP)

Table 1: Distribution of children in different clinical symptoms (N=75).

Clinical Symptoms	Numbers of children	Percentage of children
Puffiness of face	75	100%
Oliguria	75	100%
RTI	50	66.7%
Ascites	25	33.3%
UTI	25	33.3%
Hematuria	10	13.3%
Pleural effusion	15	20%
Peritonitis	10	13.3%
Hypertension	10	13.3%
Diarrhoea	20	26.7%
CCF	15	20%

DISCUSSION

In the present study, A total of 75 children of nephrotic syndrome was seen in age ranged from 1 year to 12 years. The mean age in the present study was 6 years which was similar to the results concluded from the study by Chahal OP et al.⁹ In this study, we found that clinical symptoms that children were having live puffiness of face 100%, oliguria 100%, RTI 66.7%, ascites and UTI 33.3%, hematuria peritonitis and hypertension 13.3%, diarrhoea 26.7%, and pleural effusion and CCF 20%. Similar results were concluded from the study by Siegal NJ et al.¹⁰ In this study, we found that correlation coefficient obtained was $r=0.622$ and value obtained was statistically significant (P -value < 0.001). The correlation coefficient obtained in the study was similar to the value concluded from the other study like Iyer RS et al.¹¹ ($r=0.86$), Wahbeh AM et al.¹² ($r=0.83$), Siwach SB et al.¹³ ($r=0.88$). For the diagnosis of nephrotic syndrome 24hrs UTP is still being used widely and popularly which is a lengthy and cumbersome procedure. In the present study, for all the children 24hrs UTP and spot urine protein creatinine ratio (UPr/UCr) 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

From the study, 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.

REFERENCES

- Greenbaum LA, Benndorf R, Smoyer WE. Childhood nephrotic syndrome — current and future therapies. *Nat Rev Nephrol.* 2012;8:445–458.
- McEnery PT, Strife CF. Nephrotic syndrome in childhood. Management and treatment in patients with minimal change disease, mesangial proliferation, or focal glomerulosclerosis. *Pediatr Clin North Am.* 1982;89:875–894.
- Nash MA, Edelmann CMJ, Bernstein J, Barnett HL. In: *Pediatric Kidney Disease*. Edelmann CMJ, editor. Little; 1992. pp. 1247–1266.
- Bagga A, Mantan M. Nephrotic syndrome in children. *Indian J Med Res.* 2005;122:13–28.

- Abithol C, Zilleruelo G, Frendlich M, Strauss J. Quantitation of proteinuria with urinary protein/creatinine ratios and random testing with dipsticks in nephrotic children. *J Pediatr.* 1990;116:243–7.
- Pakhale MR, Tiple N. Quantitation of proteinuria by spot urine sampling. *Int J Sci Eng Tech.* 2015;3:2395–4752.
- Newman DJ, Pugia MJ, Lott JA, Wallace JF, Hiar AM. Urinary protein and albumin excretion corrected by creatinine and specific gravity. *Clin Chim Acta.* 2000;294:139–55.
- Chakravarthy BS, Prathima Devi S. Study evaluation of urine protein/urine creatinine ratio for quantification of proteinuria in rapid and reliable diagnosis of nephrotic syndrome. *J Evid Based Med Healthc.* 2018;5:3282–7.
- Chahal OP, Bundella B, Chahal CK, Purohit M. Quantitation of proteinuria by use of single random spot urine collection. *J Indian Med Assoc.* 1993;91(4):86-7.
- Siegal NJ, Golberg B, Krassner CS. Long term follow-up of children with steroid responsive nephrotic syndrome. *J Pediatr.* 1972;81:251-8.
- Iyer RS, Shailaja SN, Bhaskaranand N, Baliga M, Venkatesh A. Quantitation of proteinuria using protein-creatinine ratio in random urine samples. *Indian Pediatr.* 1991;28(5):463-7. 12.
- Wahbeh AM, Ewais MH, Elsharif ME. Comparison of 24-hour urinary protein and protein-to-creatinine ratio in the assessment of proteinuria. *Saudi J Kidney Dis Transpl.* 2009;20(3):443-7. 13.
- Siwach SB, Kalra OP, Sharma R, Singh V, Chopra JS. Estimation of 24 hour protein excretion from single random urine specimen. *Indian J Med Res.* 1990;92:105-8.