

Original Research Article

Evaluation of protein: creatinine ratio on random urine samples in assessment of proteinuria

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ABSTRACT

Background: Significant proteinuria (>300mg/day) may indicate the presence of important renal disease. Quantitative estimation of urinary protein over 24 hours is the gold standard test for detection of proteinuria. However, 24 hours urine collection method is inconvenient and cumbersome to patients. The present study was undertaken to determine diagnostic accuracy of random urine protein: creatinine ratio for the diagnosis of proteinuria among patients with renal diseases.

Methods: The prospective study was done in 200 nephropathy cases. The 24 hours urinary protein test used as gold standard test and compared with their random urine sample protein: creatinine ratio (cut off >0.3). The data analyzed for sensitivity, specificity and accuracy of random urine sample protein: creatinine ratio test.

Results: Random urine sample protein: creatinine ratio test showed sensitivity, specificity and accuracy of 95.6%, 94.4% and 95.5% respectively

Conclusions: The convenient and accurate protein: creatinine ratio method on random urine samples is reliable method for estimation and screening the proteinuria cases over quantification of proteinuria by collection of 24 hours urine samples and hence, a wider application of this method is recommended.

Keywords: Proteinuria, Protein:creatinine ratio

INTRODUCTION

The detection of an increase in protein excretion is known to have diagnostic value in the initial diagnosis and evaluation of renal diseases. The test of quantification of proteinuria over 24 hours (300 mg/day) has considerable value in assessing renal diseases. The 24 hours urinary collection is used to smooth the fluctuations in proteinuria over the day and which ultimately gives precise results.¹

The present study was conducted to determine a diagnostic use of random urine sample protein: creatinine ratio (PC ratio) with cut off of 0.3 to find out urinary

proteinuria in Indian patients with different renal diseases.

METHODS

We studied 24 hours urine sample and morning 9 a.m. spot random urine sample collected from 200 adult nephropathy cases admitted in the tertiary care hospital. Nephropathy cases of diabetic nephropathy, hypertensive nephropathy, nephrotic syndrome, nephritic syndrome, chronic glomerulopathies and chronic kidney diseases due to unknown etiologies were included in the study. Protein and creatinine values analyzed for 24 hours urine sample and morning 9 a.m. spot urine sample.

Urine creatinine was done by utilizing modified Jaffe's kinetic method (Tulip Diagnostics Pvt. Ltd). Urine protein was measured by pyrogallol red method (Tulip Diagnostics Pvt. Ltd). The spot urine protein to creatinine ratio was obtained by dividing the urinary protein concentration (mg%) by the urinary creatinine concentration (mg%). Sensitivity, specificity, accuracy, positive predictive value and negative predictive value of the random urine PC ratio (cut off >3) for prediction of significant proteinuria was estimated using the results from the 24 hours urine protein (cut off >300 mg% /24 hours) as the gold standard.^{1,2}

RESULTS

Out of 200 patients (112 males and 88 females) included in the study, the spot urinary protein/creatinine ratio was detected to be positive in 175 patients. Of these, 174 cases had 24 hours urinary proteins level more than 300 mg% (true positive), while rest one case was false positive. Spot urinary protein/creatinine ratio was negative in total 25 patients. Out of these 25 cases, 8 were positive on 24 hours urinary protein level (false positive) while 17 were negative on 24 hours urinary protein level (true negative) (Table 1).

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of spot urinary PC ratio (Cut off >3) for diagnosis of proteinuria among nephropathy patients was 95.6%, 94.4%, 99.4%, 68% and 95.5%, respectively when the 24 hours urine protein test (cut off >300 mg%/ 24 hours) used as the gold standard. (Table 1).

DISCUSSION

An increase in urinary protein excretion is a widely accepted tool in the detection, diagnosis, and management of people considered to be at risk of developing renal disease and has been advocated as part of a regular check-up in such individuals. However, the dipstick tests are unreliable for this purpose.³

An increase in protein or albumin excretion occurs in several conditions like preeclampsia, diabetic nephropathy, hypertension, drugs nephro-toxicity and unknown etiologies. The National Kidney Foundation of USA has recommended that an increase in protein excretion be used as a screening tool in patients at risk of developing renal disease.³⁻⁶

Table 1: Comparison of spot urine protein- creatinine ratio with 24 hours urinary protein ratio (N= 200).

Spot urinary protein/creatinine ratio	24 hours urinary protein level (300mg %)			Sen.	Speci.	Accu.	PPV	NPV
	Positive >300mg%	Negative <300mg%	Total					
Positive (>3)	174	01	175	95.6%	94.44%	99.42%	68%	95.5%
Negative (<3)	08	17	25					
Total	182	18	200					

(Sen.= Sensitivity, Speci. = Specificity, Accu. = Accuracy, PPV= Positive predictive value, NPV= Negative predictive value).

The 24 hours urinary protein quantitative measurement of is the definitive test for proteinuria. Although it is well recognized test, however, that there are errors associated with the collection of 24 hours urine samples especially in outpatient setting, infants and children and also inconvenient to patients. This further adds to the cost of test which makes it an expensive procedure. Also this method may be unreliable as daily creatinine excretion fluctuates, and also reference ranges may be invalid for elderly, obese, edematous, or wasted persons who excrete considerably less creatinine per kilogram body weight.³

Several authors have studied the relationship between the urine protein to creatinine ratio and 24 hours urinary protein excretion in nephropathy patients which provides a more convenient way to calculate the protein excretion. kidney disease outcomes quality initiatives (KDOQI) of United States national kidney foundation guidelines for chronic kidney disease recommended that assessment of

proteinuria in adults and children should be conducted in spot urine sample.² Some studies show that the protein to creatinine ratio with different cut off (0.15 to 0.5 mg%) in urine samples collected in the mornings a reliable estimation of 24 hours protein in patients with nephropathy cases.^{2,7} Therefore in this study, evaluation was done with morning spot urine protein creatinine ratio with 24-hour urinary protein estimation in nephropathy cases. In the present study, the spot urine sample PC ratio with cut off of 0.3 showed sensitivity, specificity and accuracy of 95.6%, 94.4% and 95.5% respectively compared to quantitative assessment of 24 hours urinary protein in nephropathy cases. In the past, many studied has showed that PC ratio with different cut off is reliable method for evaluation of urinary protein.

Leaos-Miranda A et al showed that sensitivity, specificity of PC ratio (cut off >0.3) was 98.2% and 98.8% respectively and considered it a as reliable test.⁸ A study

by Eslamina L et al showed that for PC ratio is best predictor for significant proteinuria with sensitivity of 87.9%, specificity of 92.6%, positive predictive values of 90.6% and negative predictive values of 89.3% respectively.⁹ Shahbazian N et al found that specificity, sensitivity, positive predictive value and negative predictive value of 91.2%, 87.8%, 94.4% and 96.8% respectively with PC ratio cut off of 0.2 and showed good correlation ($r = 0.84$) between the spot P/C ratio and 24 hour urine protein excretion test.⁷ Sharma A et al found the maximum sensitivity 99.1% with PC ratio cut off point 0.14 and maximum specificity 100% with PC ratio cut off point of 0.37.¹⁰

Thus, spot urine sample PC ratio provided a simple, reliable and convenient method for quantitative assessment of protein in nephropathy cases and is better than inconvenient 24 hours urine collection method.

CONCLUSION

PC ratio of spot urine sample as an accurate, reliable test to define critical levels of proteinuria in nephropathy cases and in view of its simplicity and low cost, it can be used as a substitute for 24 hours urinary quantitative protein estimation especially in indoor, outpatients and in follow up clinics.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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