

Spot protein to creatinine ratio a good alternative to 24 hour urinary protein for diagnosis of preeclampsia

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Objective: To determine the validity of protein to creatinine ratio in comparison to 24-hour urine protein estimation in the diagnosis of preeclampsia.

Methodology: 150 pregnant women with preeclampsia defined as a BP > 140/90 and 1+ proteinuria at a gestational age > 20 weeks were recruited through outpatient department by performing a dipstick examination. A spot Protein creatinine ratio was done on mid-stream urine sample on the same day after admission. From the next voided specimen urine was collected for determination of 24 hrs urinary proteins.

Results: The mean age of the patients was 27.56±4.4 years and the mean gestational age was 34.9±2.87 weeks. 115 (76.67%) patients had positive 24-hour urine protein test for significant proteinuria. Out of these 115 (100%) also had a positive spot urine protein creatinine ratio test and none (0%) had a negative spot urine protein

creatinine ratio test. Out of 150 patients, 35 (23.3%) had negative 24-hour urine protein test for significant proteinuria. Out of these, 1 (2.8%) had a positive spot urine protein creatinine ratio test and 34 (97.2%) had a negative spot urine protein creatinine ratio test (spot urine protein creatinine ratio test accuracy 99.3%). The calculated sensitivity and specificity of the Spot urine protein creatinine ratio test in comparison to 24-hour urine protein test was 100% and 97.14%, respectively. Positive predictive value (PV+) and negative predictive value (PV?) was found to be 99.1% and 100%, respectively.

Conclusion: Protein creatinine ratio in spot urine specimens is an accurate method and a good alternative to estimate the protein excretion in cases of preeclampsia. (Rawal Med J 201;42:64-67)

Key Words: Pre eclampsia, spot protein creatinine ratio, proteinuria.

INTRODUCTION

Preeclampsia is an antenatal complication with its significant effects on fetomaternal outcome. It is characterized by hypertension and proteinuria starting after 20 weeks of gestation and settles down by 6th week postpartum. It affects about 2-8% of pregnant population. Traditionally, proteinuria is evaluated and quantified by collecting 24 hours urine sample. Although it is taken as gold standard but it is quiet inconvenient and time consuming to collect 24 hours urine sample, and can be misleading, if not done properly. It may delay the diagnosis, prolong the hospital stay and increases the health care cost. So alternatives for diagnosis of proteinuria have been considered. These include urine dipsticks, spot protein creatinine ratio and spot albumin creatinine ratio. Dipstick is rapid,

economical and convenient method for detection of proteinuria, but has sensitivity of 44% only. Spot protein creatinine ratio and spot albumin creatinine ratio has well established role for detection of proteinuria outside the pregnancy.⁻¹¹ In our study, we want to assess accuracy of spot protein creatinine ratio keeping 24 hours urine protein as gold standard for detection of proteinuria.

METHODOLOGY

It is a cross-sectional study carried out at Department of Obstetrics and Gynecology, Benazir Bhutto Hospital Rawalpindi from March to September, 2011. Sampling technique used was non-probability convenient sampling. Keeping the significance level at <10% the sample size was calculated to be 150 pregnant patients at gestation

of 20 weeks and more with blood pressure of 140/90 mm Hg with greater than or equal to +1 proteinuria on dipstick. All women with known history of kidney disease, chronic hypertension, had done heavy exercise (more than 1 hour of vigorous exercise on the day of urine collection), urinary tract infection defined as pyuria > 10 wbc/mm³, bed rest longer than 24 hours, gestational diabetes mellitus were excluded from study.

Study was presented before the hospital ethical committee for approval. 150 pregnant women with preeclampsia defined as a BP $> 140/90$ and 1+ proteinuria detected on dipstick in OPD at a gestational age > 20 weeks were recruited. Demographic details were recorded. The first mid stream urine sample on the day of admission was collected for urine spot P/C ratio. From the next voided specimen, sample was collected for a 24-hour urinary protein determination. The concentration of total protein in urine was measured by a biuret colorimetric assay (Cobas Integra Analyzer, F Hoffman-La Roche, Basel, Switzerland), and the urine creatinine level was measured by a modified Jaffe test (Hitachi 7170 autoanalyzer, Hitachi, Tokyo, Japan). Cut off for patient was set at 0.2.

Data analysis was carried out using the SPSS version 12.0. Accuracy was determined in terms of sensitivity, specificity, positive and negative predictive value. The Pearson Correlation coefficient was used to assess the linear correlation between the values of spot protein creatinine ratio and 24-hour urine protein. The level of significance was set at $p < 0.05$.

RESULTS

Age of 150 pregnant women ranged from 19 to 40 years. The gestational age ranged from 24 to 41 weeks (mean 34.9 ± 2.87 weeks). Out of total, 115 (76.67%) patients had positive 24-hour urine protein test for significant proteinuria. All of these, (100%) also had a positive spot urine protein creatinine ratio test and none (0%) had a negative spot urine protein creatinine ratio test.

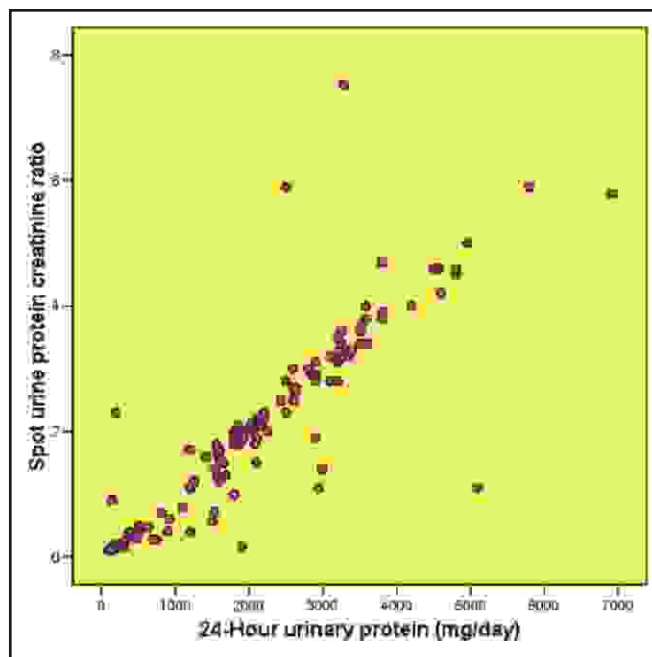
Negative 24-hour urine protein test for significant proteinuria was found in 35 (23.3%) patients. Out of these, one (2.8%) had a positive spot urine protein

creatinine ratio test and 34 (97.2%) had a negative spot urine protein creatinine ratio test.

Calculated **sensitivity** and **specificity** of the spot urine protein creatinine ratio test in comparison to 24-hour urine protein test was 100% and 97.14%, respectively. The calculated **predictive value positive (PV+)** and **predictive value negative (PV?)** of spot urine protein creatinine ratio test in comparison to 24-hour urine protein test was 99.1% and 100%, respectively.

Both 24-hour urine protein values and spot urine protein creatinine ratio had a positive linear correlation, which was statistically significant (Pearson Correlation coefficient 0.896; $p = 0.00$) (Fig. 1). When the results of **Spot urine protein creatinine ratio test** and **24-hour urine protein test** were compared using the chi-square test, it was found that patients with a positive spot urine protein creatinine ratio test had a statistically significant probability of having confirmed significant proteinuria on 24-hour urine protein test ($p = 0.00$).

Fig. 1. Correlation of 24-hour urine protein values and spot urine protein creatinine ratio.



DISCUSSION

Research is still going on, on the clinical utility of urine spot protein creatinine (P/C) ratio as an alternative of 24- hours urine protein excretion for

detection of proteinuria in patients in preeclampsia. Some authorities have recommended the use of a spot urine P/C ratio as good alternative to 24 hours urine protein excretion.⁴ However, others have conflicting results.

Our study included 150 pregnant women and calculated sensitivity and specificity of the spot urine protein creatinine ratio test in comparison to 24-hour urine protein test was 100% and 97.14%, respectively, a positive predictive value (PV+) and a negative predictive value (NPV) of 99.1% and 100%, respectively.

In most studies, it has been shown that a cut off for urine P/C ratio of 0.20 corresponds with proteinuria of 300 mg in 24 hours. So we also used the same criteria. If cut off for spot P/C ratio taken is as 0.21 (corresponding to 300 mg of protein in 24 hrs) then a significant number of patients with proteinuria i.e. upto 8.8 % can be missed.¹³

Results of our study correlates with that of a study by Shahbazian et al, which used a cut off of 0.20 for spot protein creatinine ratio, showed sensitivity and specificity of 91.2% and 87.8%, respectively. The positive predictive value found was 94.4% and negative predictive value of 96.8%. They also concluded that if a cut off of 0.19 was used, it could exclude proteinurea with 100% sensitivity.

Wahbeh et al, and Rodriquez et al studied the correlation between protein creatinine ratio and 24-hour urinary protein. They used cut off at 0.19 and found sensitivity of 90% and a specificity of 70%. So, their study concluded that the protein creatinine ratio in spot urine specimens is an accurate and reliable method for estimation of proteinuria, which is similar to results of our study. The study by Bhavna et al found good correlation ($r=0.83$, $p=0.000$) between P/C ratio and 24 hour urine protein.

Zadehmodarreset al conducted a study on 100 pregnant patients, showing a sensitivity of urine P/C of 94% and a specificity of 96%. Cut off used by them was 0.2. These results are very close to our study and the same cut off is used for both studies.

A study by Durnwaldet al showed that spot urine P/C ratio has poor positive predictive value of 61.9% and negative predictive value of 97.5%, sensitivity of 72% and specificity of 96.0%. So,

these results have failed to show a significant correlation between spot P/C ratio and 24 hours urinary protein. They concluded that spot P/C ratio is not a good alternative to 24 hours urinary protein for detection of proteinuria, which is contradictory to our results.

A very few studies have been conducted in Pakistan. One was done at Agha Khan Hospital by Ali et al on 107 patients. Two further studies were done at Sheikh Zayed Medical College and Dow University of health. All these studies showed that spot PC ratio is good alternative to 24 hours urinary protein in Pakistani population.

Results of different studies show different degree of correlation between the two tests for detection of proteinuria in pregnant population, which may be due to different cutoff values used for spot P/C ratio, different laboratory methods used for measurements of proteinuria, different units used for protein urea. Thus, valid comparison is difficult due to these variations.¹⁷

Our study had certain limitation, as it was a descriptive cross sectional study. Such study design can only help us to generate a hypothesis about a possible association or correlation. More reliable results can be obtained by a case control comparison or a prospective cohort study. Logistic regression analysis with receiver operator curve (ROC) can help us in determining a cutoff value for spot urine protein creatinine ratio and it is also important for assessment of predictive accuracy. We however, had set the cutoff at 0.20 as mentioned in the literature. So further research is required to have a more solid evidence.

CONCLUSION

We conclude that the protein creatinine ratio in spot urine specimens is an accurate method to estimate the protein excretion in urine and it is a good alternative to the 24-hour urine collection as it is simpler, faster and convenient method for the diagnosis of significant proteinuria.

Larger studies are required in this direction to further support our recommendations before the random urinary protein creatinine ratio could replace the 24-hour urine collection as equally effective but more convenient method.

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Conception and design: Ayesha Basharat
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