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Original Article

Spot urine protein–creatinine ratio and 24-h urine protein excretion: Diagnostic accuracy in women with pre-eclampsia

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ABSTRACT

Objective: To compare the efficacy of spot urinary protein/creatinine ratio with 24 h urinary protein excretion in women with pre-eclampsia.
Methods: A total of 85 women with hypertensive disorders during pregnancy were prospectively studied. Urine protein/creatinine ratio in spot urine sample was compared with 24 h urinary protein. Sensitivity and specificity for urinary spot P/C (protein/creatinine) ratio was assessed, and receiver operating curve was used to determine the value against the gold standard of >300 mg proteinuria in 24 h urinary sample.
Results: Of 85 women, complete data were available for 81 women. There was a strong correlation between spot urinary P/C ratio and 24 h urine protein excretion ($r = 0.81$, P value <0.000). The optimal spot P/C ratio cut-off point was 0.14 for 300 mg/24 h of protein excretion (preeclampsia) with a sensitivity of 82% and specificity of 79%.
Conclusion: We found a strong correlation between spot urinary P/C and 24 h urinary protein. Spot urinary protein/creatinine ratio is a good predictor of proteinuria for pre-eclampsia.

Introduction

Pre-eclampsia is an important cause of maternal and perinatal mortality and morbidity [1]. Globally, the incidence of the disease is between 5% and 8% [2]. In Pakistan, eclampsia is the second most common cause of maternal mortality [3]. In a recent hospital based study, we also found hypertensive disorders as a major cause of maternal death [4].

Correct diagnosis of the disease is important. Proteinuria is an important diagnostic criteria, and is also responsible for division of the disease in less severe to more severe categories. One of the gold standards for diagnosis of proteinuria is the presence of protein in a 24 h urinary sample. Significant proteinuria during pregnancy is defined as an excretion of $\geqslant$300 mg of protein during 24 h or a random spot urine protein/creatinine ratio of >30 mg/mmol by the International Society for the Study of Hypertension in Pregnancy (ISSHP) [5].

Though 24 h urine collection gives a quantitative estimation of protein excretion, it is cumbersome and time consuming. A spot estimation of urinary protein/creatinine ratio has been found to be more effective, reliable and less time consuming for the diagnosis of proteinuria in non pregnant patients [6]. The clinical significance of spot urinary protein/creatinine ratio during pregnancy has been investigated by many researchers, without any consensus opinion. In a prospective study of 85 pregnant pre-eclamptic women, Shahbazian et al., found a strong correlation

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between the spot P/C ratio and 24-h urinary protein excretion ($r = 0.84$; $P < 0.001$) [7]. Similarly Rodriguez-Thompson and Lieberman, also found that a cut off of $\geqslant 0.19$ yields a sensitivity of 90% and a specificity of 70% [8]. Other investigators did not find spot urinary protein/creatinine ratio as a suitable indicator of pre eclampsia [9,10]. Thus clinically, the significance of spot urinary protein/creatinine ratio in establishing a diagnosis of proteinuria in pre-eclampsia remains uncertain.

This study was done to see the correlation between 24 h urinary protein and spot urinary protein/creatinine ratio in pregnant Pakistani women with a diagnosis of preeclampsia.

Materials and methods

This prospective study was done at the Department of Obstetrics & Gynecology Unit III, Civil Hospital Karachi (CHK) & Dow University of Health Sciences (DUHS), in collaboration with Dow Diagnostics & Research Reference Laboratory. CHK is a tertiary care hospital, with >10,000 deliveries annually. The study period was from January 2009 to March 2010. All pregnant women who were admitted in Unit III, with the diagnosis of preeclampsia after 20 weeks of gestation, were included. Pre-eclampsia (PE) was defined as new onset hypertension (systolic $\geqslant 140$ mmHg, and diastolic blood pressure of $\geqslant 90$ mmHg) after 20 weeks of gestation, along with proteinuria of $\geqslant 300$ mg/dl in 24 h. Exclusion criteria included women with known renal disease, urinary tract infection and established diabetes mellitus. Women who did not complete either 24 h urinary collection, or missed spot urinary protein/creatinine sample, or who delivered while being admitted for the test were excluded from the study. The study was approved by the Institutional Review Board of DUHS.

Urine analysis

Once the diagnosis of PE was made, women were admitted for 24 h for in patient stay. A spot urine sample was obtained for protein/creatinine ratio, followed by provision of bottles for 24 h urinary collection. The specimens were labeled and sent to laboratory, the same day, once the collections were completed. The urine protein/creatinine (P/C) ratio was determined on spot urinary protein samples. It was obtained by dividing the urinary protein concentration by urinary creatinine.

Statistical analysis

Descriptive statistics were used for demographic data, and summarized as mean ± standard deviations. The correlation between 24 h urinary protein and PC ratio in spot urine sample was analyzed, using the Pearson correlation test. Sensitivity and specificity of random urine P/C ratio at various cut off points were estimated, taking 300 mg/24 h urinary protein excretion as the gold standard. The receiver operating characteristic curve (ROC) was used, and area under the curve was calculated.

Results

A total of 85 women with pre-eclampsia were enrolled in the study. Four women were excluded from the study, due to incomplete data; hence 81 women finally completed the study. The mean age of the women was 28 ± 4.62 years (range 18–35 years). The mean gestational age was 31 ± 5.3 weeks. The median serum creatinine was 0.6 mg/dl and the mean protein/creatinine ratio was 1.14 ± 1.87 mg/dl (range 0.03–9.73). The correlation coefficient for the protein/creatinine ratio against the 24 h urine protein excretion was ($r = 0.81$, P value <0.000).

The ROC curve for the random urinary protein/creatinine ratio is shown in Fig. 1. The area under the curve is 0.90 (0.834–0.965). The cut-off point of 0.14 was identified as the best threshold to detect urine protein excretion of $\geqslant 300$ mg/24 h, with a sensitivity of 82% and specificity of 79% (81.1% positive predictive value and 79% negative predictive value). There was a strong correlation between spot urinary P/C ratio and 24 h urine protein excretion.

Discussion

The results of our study showed a strong correlation between spot urinary P/C ratio and 24 h urine protein excretion.

A 24-h urine collection for protein is usually taken as the gold standard for diagnosis of significant proteinuria [9]. However, it is not only time consuming, costly and difficult, it may also be inaccurate due to inadequate collection [11]. Moreover, it usually leads to a delay in diagnosis and management [9]. It has also been reported that less than half the

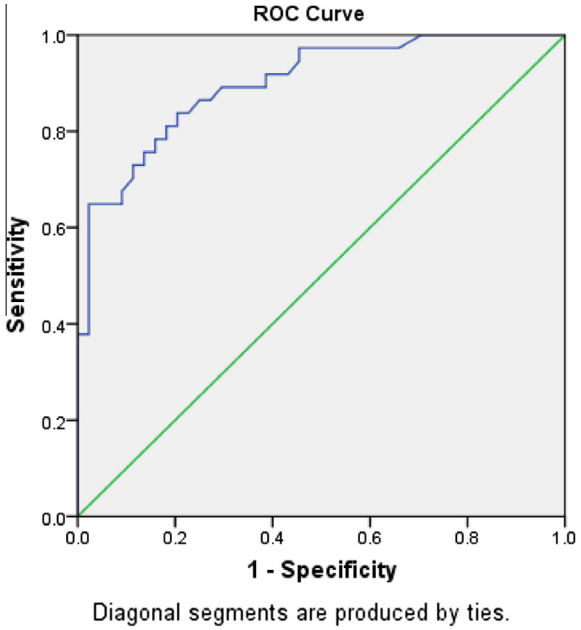

Fig. 1. There was a strong correlation between the spot-urinary protein creatinine ratio and 24 h urinary protein excretion ($r = 0.81$, P value <0.000).