Correlation Between Spot Urine Protein/Creatinine Ratio With 24 Hours Proteinuria in Pre-Eclamptic Women

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ABSTRACT *Introduction: Appearance of proteinuria remains an important diagnostic criterion of pre-eclampsia. Pre-eclampsia poses a great hazard to both the mother and the fetus with adverse outcomes, thereby necessitating early detection for proper management. The gold standard test for the diagnosis of significant proteinuria remains the 24-hours urine collection. Because of disadvantages of it, the current study has been designed to evaluate the usefulness of spot urinary protein : creatinine ratio collected before a 24 hour urine collection for diagnosis of significant proteinuria.Materials and Method: 62 pre-eclamptic women with gestational age >20 weeks and with proteinuria +1 or more were studied. First a single voided urine specimen for spot urinary protein: creatinine ratio was taken then 24 hr. urine collection was started. Protein in 24 hr urine was measured by Pirogallol red colorimetric method. In spot urine sample protein was measured by biuret test, and creatinine was measured by modified Jaffe test separately. By these test values protein/creatinine ratio was calculated. Observation and results: With 25-30 years age group, most of our patients were booked(66.13%), middle class(67.74%), hindu(95.16%), form urban areas(67.74%) and literate(79%) and nulliparous(59.68%). 43.55% women were in 29-32 weeks of gestation. 20.97% were in 33-36 weeks and 17.74% patients each were in 24-28 weeks and >36 weeks gestation period. Mean 24 hour urinary protein in our study was 1.5119 ± 1.4107 gm/d. Mean spot sample P:C ratio was 1.6532 ± 1.5662 with Pearson correlation coefficient r=0.979 with p value < 0.0001 showing strong linear coefficient. Conclusion: We conclude that the protein-to-creatinine ratio in spot urine specimens is an accurate, convenient, and reliable method to estimate the protein excretion in urine. In pregnancy induced hypertension, measurement of the protein/creatinine ratio is a simple and inexpensive alternative to 24 hour urine protein estimate for quantitation of proteinuria.*

Introduction:

Pre-eclampsia is much more than simply gestational hypertension and proteinuria, appearance of proteinuria remains an important diagnostic criterion. The incidence is influenced by parity, with young and nulliparous women having a greater risk. Proteinuria is defined as a 24- hours protein excretion rate of greater than 0.3g and is considered to be severe when the excretion is greater than 3.5 g.[1] These criteria are based on measurement of proteinuria in a timed, 24-hours urine collection.[2] The gold standard test for the diagnosis of significant proteinuria remains the 24-hours urine collection.[3] Pre-eclampsia poses a great hazard to both the mother and the fetus with adverse outcomes, thereby necessitating early detection for proper management. Twenty- four-hours urine collections have been criticised as being cumbersome and inaccurate, especially in ambulatory patients.[4] This procedure also delays diagnosis by at least 24 hours. It is associated with many errors[5] including incomplete collections, bacterial growth, incorrect timings and incomplete bladder emptying. These errors far exceed those caused by diurnal variation in protein excretion. Because of the disadvantages of 24 hour urine collection, alternatives for the diagnosis of proteinuria in pregnancy have been considered like protein: creatinine ratio in random urine sample. The current study has been designed to evaluate the usefulness of spot urinary protein : creatinine ratio collected before a 24 hour urine collection for diagnosis of significant proteinu-

ria. The objective of our review is to determine the accuracy of the protein/creatinine ratio in predicting 300 mg of protein in 24-hour urine collection in pregnant patients with suspected preeclampsia.

Materials and methods:

This is a hospital based descriptive type of observational study. The study has been conducted in the Department of Obstetrics and Gynaecology, SMS Medical College for comparative estimation of spot urinary protein/creatinine ratio with 24 hrs proteinuria in 62 pre-eclamptic women with gestational age >20 weeks and with proteinuria +1 or more after giving written informed consent. 62 pre-eclamptic women with gestational age>20 weeks with proteinuria +1 or more were studied. But patients with Women with bacteriuria , Urinary tract infections, Renal disorders, multiple pregnancy, Chronic hypertension, Medical disorders like thyroid, diabetes and collagen vascular diseases and Eclampsia were excluded from study. First a single voided urine specimen for spot urinary protein: creatinine ratio was taken. Then 24 hr. urine collection was started. 24 hr urine was collected in a clean bottle and last sample was taken on next day at the same time. Mid stream clean catch specimen was collected for spot urine. Protein in 24 hr urine is measured by Pirogallol red colorimetric method. In spot urine sample protein is measured by Biuret test, and creatinine is measured by modified Jaffe test separately. By these test values protein/creatinine ratio is calculated. Then compared with each other find out correlation.

Observation and results:

Most of our patients were from 25-30 years age group and mean age was 27.39 ± 3.261years. Maximum number of women were booked(66.13%) and literate(79%). There were more number of nulliparous women(59.68%) than primipara(30.64%) or multipara(9.68%). This study included women with gestational age of 24-40 weeks. Most of our patients(43.55%) were between 29-32 weeks of gestation period. 20.97% were in 33-36 weeks and 17.74% patients each were in 24-28 weeks and >36 weeks gestation period. Among 62 cases mean period of gestation was 31.55 weeks with standard deviation of 4.124. In 62 women, 12 (19.35%) had non-significant (trace) amount of proteinuria i.e <0.30gm/day [Table 1] and 13 women (20.96%) had spot sample P:C ratio <0.30 [Table 2] with mean of 0.1925 ± 0.04693 and 0.1646 ± 0.04093 respectively. The correlation coefficient between these was 0.4061 with p value of 0.1902 which is statistically non-significant[Table 5]. 42 women (67.74%) had 0.3-3.5 of 24 hr urinary protein with mean of 1.336 ± 0.8499 gm/day [Table 1] whereas 0.30-3.5 of spot sample P:C ratio were present in 66.13% of patients with mean of 1.4415 ± 0.8802[Table 2]. The correlation coefficient between these was 0.9434 with p value of < 0.001 which shows significant correlation[Table 5]. 12.91% of patients had >3.5 gm/d of 24 hr urinary protein with mean of 4.4125 ± 0.5693 gm/d [Table 1] whereas same value of spot sample P:C ratio were present in 9 (14.52%) patients with mean of 4.7444 ± 0.5897 [Table 2]. The correlation coefficient between these was 0.8264 with p value of < 0.001 which shows significant correlation[Table 5]. Mean 24 hour urinary protein was 1.5119 ± 1.4107 gm/d. Mean spot sample P:C ratio was 1.6532 ± 1.5662. Pearson correlation coefficient r=0.979 with p value < 0.0001 [Table 3]. It means that mean values of 24 hour urinary protein and spot sample P:C ratio is almost linearly correlated and is statistically significant.

Table 1: Distribution of Cases According to 24 Hours Urinary Protein

24 Hours Urinary Protein (gm/day)	No.	%	Mean (gm/d)	S.D.
0 - 0.30 (Nonsignificant)	12	19.35	0.1925	0.04693
0.31 - 3.5(Significant proteinuria)	42	67.74	1.3364	0.8499
>3.5 (Severe proteinuria)	8	12.91	4.4125	0.5693
Total	62	100.00	1.512	1.4107

Mean-1.512   S.D.- 1.4107

Table 2: Distribution of Cases According to Spot Sample Protein / Creatinine Ratio (P : C)

P : C	No.	%	Mean	S.D.
0 - 0.3 (nonsignificant)	13	20.96	0.1646	0.0509
0.31 - 3.5 (significant proteinuria)	40	64.52	1.4415	0.8802
>3.5 (severe proteinuria)	9	14.52	4.7444	0.5897
Total	62	100.00	1.6532	1.5662

Mean- 1.6532   S.D.- 1.5662

Table 3: Correlation between Mean 24 hour urine protein and mean spot sample P:C ratio

Mean 24 hour urinary protein	Mean spot sample P:C ratio	Correlation Coefficient	p value
1.5119 ± 1.4107	1.6532 ± 1.5662	0.979	<0.0001

Table 4: Distribution of cases according to Mean 24 hour urine protein and mean spot sample P:C ratio values

Category	Mean	Std. Dev.	No. of pts.
Nonsignificant			
24 hr urinary protein	0.1925	0.04693	12
Spot sample P:C ratio	0.1646	0.05093	13
Significant proteinuria			
24 hr urinary protein	1.3364	0.8499	42
Spot sample P:C ratio	1.4415	0.8802	40
Severe proteinuria			
24 hr urinary protein	4.4125	0.5693	8
Spot sample P:C ratio	4.7444	0.5897	9

Table 5: Category wise correlation in 24 hour urinary protein and spot sample P:C ratio

S. No.	Category [24 hrs urinary protein (gm/day) and spot sample p:c value]	r (correlation coefficient)	p value
1.	Non significant proteinuria (0-0.30)	0.4061	0.1902 (nonsignificant)
2.	Significant proteinuria (0.31-3.5)	0.9434	<0.001 (significant)
3.	Severe proteinuria (>3.5)	0.8264	<0.001 (significant)

Discussion:

Preeclampsia is a common complication of pregnancy with the potential for serious maternal and perinatal outcomes. The presence of significant proteinuria is one of the key elements required for a correct diagnosis.

24 hour urine collections are often used during pregnancy to quantify proteinuria. The need for a 24-hour collection is a result of the high degree of variation in the urinary protein concentration during the course of the day. This precludes the use of a shorter collection period or the use of a random urine sample for protein concentration measurements. Several authors have investigated the variation in protein excretion during the day and found that values can vary from 100% to 500%. This variation is thought to be attributable to several factors, including variation in water intake and excretion, rate of diuresis, exercise, recumbency, and diet. The variation may be further exacerbated by pathologic changes in blood pressure and renal architecture. 24-hour urine collections are cumbersome, subjective to collection error, require patient compliance, and result in a greater than 24 hour delay in diagnosis from the start of the collection. An alternative approach that has been proposed, and used in some clinical situations for many years, is that of expressing the protein excretion in a random urine collection as a ratio to the creatinine concentration. It is assumed that both the protein and creatinine excretion rates are fairly constant during the day, as long as the glomerular filtration rate remains constant. The reason for changes in the protein concentration in individual samples during

the day is variation in the amount of water excreted. To support this proposal, several investigators have demonstrated a smaller variation in the protein:creatinine ratio compared with the protein concentration alone in urine samples collected throughout the day. Thus, Newman DJ et al.(2000)[6] found that the mean intra individual variation in the protein:creatinine ratio was 38.6%, whereas that of the protein excretion was 96.5%. Koopman et al.(1989) [7] had made a similar observation. Several investigators studied the relationship between the protein:creatinine ratio and 24-h protein excretion. Reliance on a voided urine P:C ratio decreases the need for patient compliance, minimizes collection and laboratory errors, and saves almost a day in ascertaining the results. Ginsberg JM(1983) et al.[8] reported a correlation coefficient of 0.972. These authors concluded on the basis of these data that the protein:creatinine ratio of a spot urine could be used as a reliable indicator of the 24-h protein excretion. Several investigators have made similar observations and drawn similar conclusions, whereas others have stated a preference for the first sample collected after the first morning void. In our study when proteinuria was not significant (trace) then 24 hour urinary protein and spot sample P:C ratio were not correlated significantly but this is statistically not significant as p value is >0.005(0.16).But in cases of significant proteinuria these are almost linearly correlated which is statistically significant as p value is <0.001 with Pearson correlation coefficient r=0.9791.In study by Bansal Bhavna et al(2009)[9], there was a significant correlation between 24 hour urine protein and P:C ratio (r=0.83, p=0.000). A statistically significant linear relationship between 24 hour urine protein and P:C ratio exists in the PIH cases. Robert M et al(1997)[10] found close correlation between the two in 71 hypertensive pregnant women (r=0.94, p<0.001). Rodriguez-Thompson D et al(2001)[3] also showed close correlation in 138 females (r=0.80, p < 0.001). In study by Ayman M Wahbeh et al(2009)[11] there was found a very good correlation between spot urine (PCR) and 24-hour urine total protein (UP) (r= 0.832, P= 0.0001). In study by Pallavi Patil et al(2014)[12] ,UP/C ratio and 24 hour urine protein estimation had found strong correlation with r = 0.9 and p < 0.05 on Pearson's correlation analysis.
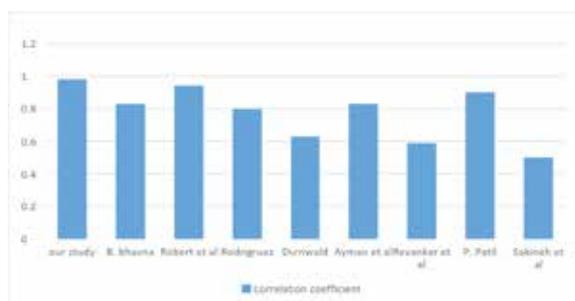
Conclusion:

We conclude that the protein-to-creatinine ratio in spot urine specimens is an accurate, convenient, and reliable method to estimate the protein excretion in urine. The use of 24 hour urine collection for the management of proteinuria delays the diagnosis, is difficult and is sometimes unreliable because of incomplete collections. In pregnancy induced hypertension, measurement of the protein/creatinine ratio is a simple and inexpensive alternative to 24 hour urine protein estimate for quantitation of proteinuria.

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