Section: OBGY

Original Research Article

CORRELATION OF PROTEIN/CREATININE IN SINGLE VOIDED URINE SAMPLE WITH 24 HOURS URINE PROTEIN IN 90 CASES OF HYPERTENSIVE DISORDERS COMPLICATING PREGNANCY

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Received *: 26/06/2025*
Received in revised form *: 16/08/2025*
Accepted *: 03/09/2025*

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DOI: 10.70034/ijmedph.2025.3.491

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 2680-2684

ABSTRACT

Background: Hypertensive disorders during pregnancy affect nearly 10% of expectant mothers and continue to be a significant contributor to maternal health issues and fatalities. The objective is to compare the Protein/creatinine ratio (P: C) in the single voided sample with 24-hour urine protein for estimation of proteinuria in Hypertensive Disorders of Pregnancy.

Materials and Methods: Study Design is Hospital-based prospective Observational study. Study area: Department of Obstetrics & Gynecology, gayatri vidya parishad institute of health care and medical technology, Vishakhapatnam, A.P. Study Period are 8 months. Study population is pregnant women with hypertensive disorders of pregnancy, admitted to the Department of Obstetrics and Gynaecology, GAYATRI VIDYA PARISHAD INSTITUTE OF HEALTH CARE AND MEDICAL TECHNOLOGY, Vishakhapatnam, A.P. Sample size is the study consisted of a total of 90 subjects.

Results: A fair correlation coefficient of r = 0.902 was observed between the 24 hours urine protein and spot urine protein/creatinine ratio among 90 subjects which was statistically significant at p value <0.001.

Conclusion: The spot urine protein/creatinine ratio provides a reliable, cost-effective, and patient-friendly alternative to 24-hour urine collection for quantifying proteinuria in preeclampsia. Its accuracy, ease of use, and suitability for repeated outpatient monitoring make it a valuable tool for early detection, timely management, and improved maternal and perinatal outcomes.

Keywords: Hypertension, Preeclampsia, spot urine protein/creatinine ratio.

INTRODUCTION

Hypertensive disorders during pregnancy affect nearly 10% of expectant mothers and continue to be a significant contributor to maternal health issues and fatalities.[1] Antenatal care includes a screening protocol that involves more frequent measurements of blood pressure and protein levels as the pregnancy nears term, utilizing this data to identify hypertensive conditions in pregnancy.

Preeclampsia is a complex disorder with an unknown cause, defined by the onset of high blood pressure (140/90 mm Hg or above) alongside proteinuria occurring after the 20-week gestational age in women who were previously not hypertensive and had no proteinuria. Proteinuria is identified when there is 300 mg or more of protein found in a 24-hour urine sample. The ideal method for assessing protein in urine through a 24-hour collection process is prone to mistakes, the most noticeable of which is the

inconsistency and incompleteness of collection. This method presents challenges due to its inconvenience and the associated delays in lab testing and result availability. Inadequate storage solutions, staffing shortages, and issues with transportation further complicate the process. Furthermore, there are instances where the patient may give birth before finishing the 24-hour urine collection, often necessitating hospital admission to finalize the test.[2] The analysis of the urine protein to creatinine ratio has demonstrated encouraging outcomes and shows a strong correlation with the protein excretion measured over 24 hours.3-5 Thus, it may serve as a viable option for the traditional 24-hour urine protein excretion test.

Aim: To evaluate the ability of the random urine P/C ratio to predict significant proteinuria, as well as to introduce a diagnostic test for preeclampsia that would avoid the inconvenience and time consumption of 24-hour urine protein collection.

Objectives: To compare the Protein/creatinine ratio (P: C) in the single voided sample with 24-hour urine protein for estimation of proteinuria in Hypertensive Disorders of Pregnancy.

MATERIALS AND METHODS

Study Design: Hospital-based prospective Observational study.

Study area: Department of Obstetrics & Gynecology, Gayatri Vidya Parishad Institute Of Health Care And Medical Technology, Vishakhapatnam, A.P.

Study Period: 8months

Study population: Pregnant women with hypertensive disorders of pregnancy, admitted to the Department of Obstetrics and Gynaecology, Gayatri Vidya Parishad Institute Of Health Care And Medical Technology, Vishakhapatnam, A.P.

Sample size: The study consisted of a total of 90 subjects.

Sampling Technique: All cases were approached and who have given consent were taken for study

Inclusion Criteria:

Pregnant women

1. Booked & Unbooked Cases
2. Hypertensive pregnant women with ≥20 weeks of gestational age with a new onset of blood pressure of 140/90 mmHg or more on two occasions at least 6 hours apart or a single diastolic reading of ≥ 110mmHg which includes Gestational Hypertension, Preeclampsia, Eclampsia.

Exclusion criteria:

1. Those with ≤20 weeks of gestational age
2. Patients with ≥20 weeks of Gestational age having Urinary tract infections, Diabetes mellitus
3. Chronic hypertension, pre-existing renal disorders, Hypothyroidism, Thyrotoxicosis, and those receiving diuretics, corticosteroids, NSAIDs and sympathomimetic drugs.

Ethical consideration: Institutional Ethical committee permission taken before the commencement of the study.

Study tools and Data collection procedure:

Investigations

- Complete blood count
- Urine albumin, sugar, microscopy.
- Urine culture and sensitivity
- 24 hours urine protein
- Spot protein/creatinine ratio.
- Peripheral smear Bleeding time,clotting time
- Liver function tests
- Renal function tests

A study was carried out on 90 (booked and unbooked) antenatal cases with hypertensive disorders in pregnancy of gestational age ≥ 20 weeks.

A detailed history was taken, general, physical and systemic examination including the obstetric examination done.

SEMI QUANTITATIVE ANALYSIS BY DIPSTICK was done and graded as follows

Grading	Proteinuria
Negative	<10mg/dl
Trace	10-20mg/dl
1+	30mg/dl
2+	100mg/dl
3+	300mg/dl
4+	1000mg/dl

The patients were instructed to collect 24 hours of urine starting from the second urine sample in the morning (ie; after discarding the first-morning specimen) till the first urine sample the next day morning. A single voided urine specimen will be obtained soon after the 24-hour urine collection, before mid-day.

The samples will be sent to the Biochemistry laboratory where:

Urine protein will be measured by the turbidometry method. The test will be performed on a semi-automated analyzer.

Urine creatinine will be measured by the Jaffe's reaction. The test was performed on a semi-automated analyzer.

The urine protein and creatinine ratio will be obtained by dividing the urine protein concentration (mg /dl) by the urine creatinine (mg/dl).

	24 hours urine protein (mg/24 hours)	Protein/creatinine Ratio
Negative	< 300	< 0.3
Clinically significant proteinuria	> 300	> 0.3
Severe proteinuria	> 3000	Ratio > 3

The data was collected and analyzed using appropriate statistical methods. The mean and standard deviations were computed. The statistical tests used for analyses were the student chi-square test expressed as p. A value of $p < 0.05$ has been considered to be statistically significant.

RESULTS

Table 1: Age distribution in the study group

Age group	No. Of women	Percentage
18-20years	7	7.8%
21-25 years	19	21.1%
26-30 years	47	52.2%
31-35years	15	16.7%
36-40years	2	2.2%
Total	90	100%
MEAN ±Std dev	27.14±4.06 yrs	

In the present study, it is observed that the mean ±SD of age of the subjects studied was 27.14±4.06 yrs minimum age is 19years maximum age is 36 years. maximum number of women are present in between 26-30 years of age group. Majority of subjects having hypertension were primigravidas constitutes 62%.

Table 2: Distribution of gestational age at presentation

Gestational age	N (90)	Percentage
26-28weeks	11	12.2%
29-32weeks	23	25.5%
33-36weeks	42	46.8%
37-40weeks	14	15.5%
Total	90	100%

Most patients with hypertension belonged to 33-36 weeks gestational age (46.8%). minimum age at presentation was 26weeks and maximum gestational age at presentation was 40 weeks. And the mean gestational age was 33.45±3.32.

The systolic blood pressure in the study group on the day of admission, maximum number of women had systolic blood pressure between 140-159mm of Hg (58%). Mean SBP is 155.08±12.89mm of Hg. The diastolic blood pressure on the day of admission was 90mm of Hg in 20%,100 mm of Hg in 56%,110 mm of Hg in 16%, in 8% the diastolic blood pressure was 120mm of Hg. The mean diastolic blood pressure was101.2±8.2mm of Hg.

Table 3: 24 hours urine protein

24 hours urine protein	N (90)	Percentage
<300mg	21	23.3%
300-1mg	27	30%
1-2mg	19	21.1%
2-3mg	7	7.7%
>3mg	16	17.9%

In this study women having 24 hours urinary protein <300mg was 23.3%,300- 1mg/24 hours was 30%, 1-2/24 hours was 21.1%, 2-3/ 24hours was 7.7%, 17.9% of women had proteinuria of >3mg/ 24 hours, majority of women had proteinuria between 300-1mg/24 hours.

Table 4: urine spot protein cratinine ratio in study group

Urine Spot Protein Creatine Ratio	N (90)	percentage
<0.3	22	24%
0.4-3	54	58%
>3	14	18%
Total	90	100%

In study group 58% women had spot urine protein creatinine between 0.3-3, 24% has <0.3 and 18% has >3 urine spot protein creatinine ratio.

Table 5: Mean and SD of 24-hour urine protein and P/C ratio in gest. HTN, mild and severe PE group

	Mean	Std deviation
Gestational hypertension		
24hr protein	173.2545	82.84927
PC ratio (n=22)	0.12	0.12
Mild preeclampsia		
24hr protein	1010.79	457.38614
PC ratio (n=44)	1.29	0.78
Severe eclampsia		
24 hr protein	3387.00	1867.07
PC ratio (n=24)	4.65	3.56

Table 6: Pearson's correlation coefficient between 24 hr protein and P/C ratio, in gest. HTN, Mild and severe preeclampsia group

Severity of Disease	N (90)	r	p	
Gest. HTN	22	0.591	0.055	Significant p value
Mild Preeclampsia	44	0.888	<0.001	Very significant p value
Severe preecla mpsia	24	0.814	<0.001	Very significant p value

A fair correlation coefficient of r = 0.902 was observed between the 24 hours urine protein and spot urine protein/creatinine ratio among 90 subjects which was statistically significant at p value <0.001. It was noticed that the correlation coefficient at lesser degree of proteinuria (i.e. less than 300mg) was less (0.59), as compared to other two groups, but statistically significant at p value 0.055.

Mean proteinuria was 1542 ± 1.64 when all 90 subjects were considered, and mean P/C ratio was 2.06 ± 2.65.

Table 7: Correlation coefficient between spot Protein-Creatinine ratio, and 24-hour sample of urine protein (mg), in all subjects

Karl Pearson's Correlation between	Correlation Coefficient (r)	P value
Spot Protein Creatinine ratio 24-hour sample of urine protein (mg)	0.90	<0.001

A fair correlation coefficient of r = 0.902 was observed between the 24 hours urine protein and spot urine protein/creatinine ratio among 90 subjects which was statistically significant at p value <0.001.

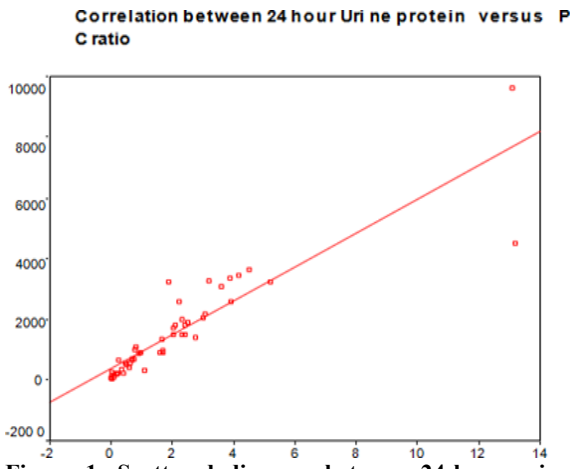

Figure 1: Scattered diagram between 24-hour urine protein and protein /creatinine ratio.

The central line is best fit due to regression coefficient i.e. r= 0.90 (p<0.001), when the 24-hour urine protein was 300mgs-3gms and the protein/creatinine ratio is also 0.3-3.

It was noticed that the correlation coefficient at lesser degree of proteinuria (i.e. less than 300mg) was less (0.59), as compared to other two groups, but statistically significant at p value 0.055.

DISCUSSION

Prompt and precise identification and measurement of proteinuria are crucial for handling hypertensive complicating pregnancy. This enables us to assess the severity of proteinuria sooner, providing insight into the seriousness of the condition, which can influence the management approach.

All the patients were aged between 19-36 years. 7.8%were in between age 18-20 years, 21.1%were between 21-25years, 52.2%were between 26-30 years,16.7%between 31- 35 years and 2.2% were between 36-40 years age group. Minimum age is 19years maximum age is 36 years. Maximum number of subjects were in 26-30 years of age group. the mean age of the patients was 27.14 years. In a study conducted by Bhansal Bhavana et al,[6] the mean age group 26.9 years which is comparable to the present study.

It shows majority of subjects having hypertension were primigravidas constitutes 62%. In Hossaain et al7 study maximum number of women were having hypertension were primigravidas (78%) which is comparable to present study. All the patients in the study group were divided according to the gestational age, 12.2% were between 26-28weeks of gestation, 25.5%were between 29-32weeks of gestation, 46.8%were between 33-36 weeks of gestation and 15.5% were between 37- 40weeks of gestation. Maximum number of women were between 33-36 weeks of gestational age. mean gestation age in present study was 33.45 weeks. Which is comparable to study of Sangappa virupaxappa Kashinakunti et al,[8] it was 33.5. The minimum gestational age was 27 weeks maximum gestational age was 40 weeks of gestation. In the present study out of 90 subjects studied 22 (24.4%) were having Gestational HTN, 44 (48.9%) were having mild pre-eclampsia and 24 (26.7%) were having severe pre-eclampsia.

The patients having SBP between 140-159mm of Hg is 58%, between 160- 180mm of Hg was 40% and between 181 to 200 was 2%. Most of the patients were between having SBP between 140-159mm of Hg. Mean SBP was 155.08mm of Hg. which is comparable to the Jaya Choudary et al study.[9] Mean Diastolic Blood Pressure at the time of admission was 101.2mm of Hg. which was comparable to the study of Amita sharma et al.[10]

Table 8: 24 hours urine protein and urine spot protein creatinine ratio

Studies	Correlation Coefficient (r)	p-value
Boler et al,[11] (1987) n=54	0.99	< 0.001
Jaschevatzky et al,[12] (1990) n=105	0.94	< 0.001
Robert et al,[13] (1995) n=71	0.94	< 0.001
Sauden et al,[14] (1997) n=100	0.93	< 0.001
Neithardt et al,[15] (2000) n=30	0.93	< 0.001
Present study n=90	0.90	< 0.001

All of the previous studies demonstrate an excellent correlation between the 24 hrs urine protein and the protein/ creatinine ratio. The p values are also statistically very significant at <0.001 which is also seen in our study. We found a fair degree of correlation in our study, when the 24 hours urine protein and the random urine protein-creatinine ratios were correlated with r = 0.90 and the p value being highly significant at <0.001, when all the observations were considered. It was noticed in our study that the correlation coefficient at lesser degree of proteinuria (i.e. less than 300mg) was less (0.59), as compared to other two groups, but statistically significant at p value 0.055. Boler et al11 in his study, found an good correlation between the 24 hrs urine protein and the protein/ creatinine ratios at lower levels of proteinuria but when the protein losses were > 1 gm/24 hrs, found more pronounced correlation with significant p value.

In 90 number of subjects only 18 subjects had severe degree of proteinuria >3 gms, and the correlation was found to be good at r = 0.77 and p<0.001. The study was limited to hospitalized patients. Since the protein excretion is affected by postural change, being higher in the standing than in supine position, the ambulatory status of the patients is important while interpreting the results.

We have found the use of this alternative test to 24 hours urine protein to be much more cost effective as shown with many studies previously. We have also found the 24 hours urine collection to be cumbersome and inconvenient for a pregnant woman. Since the present study included women only with a stable renal function, our study supports the use of the protein/creatinine ratio in women with normal renal function. But Robert et al,[13] and Quadri et al,[16] have proved in their studies that the protein/creatinine ratios are independent of renal function and reliable even in the presence of underlying renal disease and have advocated their use to monitor renal function in pregnancy.

CONCLUSION

The spot urine protein/creatinine ratio provides a reliable, cost-effective, and patient-friendly alternative to 24-hour urine collection for quantifying proteinuria in preeclampsia. It's accuracy, ease of use, and suitability for repeated outpatient monitoring make it a valuable tool for early detection, timely management, and improved maternal and perinatal outcomes.

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