Original Article

Comparison of the Spot Urine Protein Creatinine Ratio with 24 Hours Urine Protein Excretion in Women with Pre-Eclampsia

Samina Shaikh[1], Atteya Abbasi[2], Ferhat Sultana[3], Sabreena Talpur[4], Farhana Shaikh[5], Farhana Anjum[6]

[1,3]Senior registrar Dept of Obs & Gynae, LUMHS [2]Registrar Dept of Obs & Gynae, LUMHS
[4]Assistant Professor Dept of Obs & Gynae LUMHS [5]Associate Professor of Obs & Gynae LUMHS
[6]Associate Professor of Obs & Gynae. Isra University Hospital Hyderabad

Correspondence: **Dr. Samina Shaikh**
Senior registrar Dept of Obs & Gynae, LUMHS
saminashaikh5500@gmail.com

Abstract

Objective:To assess the diagnostic accuracy of random urine protein / creatinine ratio for the prediction of significant proteinuria in women with pre-eclampsia.

Methodology:The descriptive study was conducted in the department of Obstetrics/Gynecology at Liaquat University Hospital Jamshoro/Hyderabad from Oct 2016 to April 2017. Patient more than 20 weeks of gestation with hypertension with all age group and parity were included. All women were asked to provide a 24 Hours urine collection. The patients were advised to pass urine at 8:00 AM and collect all urine subsequently till 8:00 AM next morning Random sample for P/C ratio collected the next morning simultaneously after 24 Hours urine collection is over. Urinary protein quantification was done by biuret method and urinary creatinine by modified Jaffe's method.

Results: Total 60 women were studiedtheir mean age was 28.32±4.65 years. 26.6% women had gestational hypertensive, 43.3% were mild pre-eclamptic and 30.0% were severe pre-eclamptic. It was noted that the correlation coefficient at lesser degree of proteinuria (i.e less than 300mg) was less (0.69), as compared to other two groups, but statistically significant at (p-0.044). A fair correlation coefficient of r= 0.802 was observed between the 24 hours urine protein and spot urine protein/Creatinine ratio among 60 women which was statistically significant at p value <0.001. It was noticed that the correlation coefficient at lesser degree of proteinuria (i.eless than 300mg) was less (0.802), as compared to other two groups, but statistically significant at (p-0.04).

Conclusion: Significant correlation coefficient was observed between the 24 hours urine protein and spot urine protein/Creatinine ratio. It was observed to be useful in an outpatient setting to predict clinically significant proteinuria and to monitor renal functions in such women with lesser degrees of proteinuria thus avoiding unnecessary Hospital admissions. Method for quantitation of proteinuria, when properly interrupted, can provide valuable information that for clinical purposes is a satisfactory substitute for testing 24hour urine protein for the diagnosis of preeclampsia.

Key words: Spot urine protein/ creatinine ratio, 24-hour urine protein excretion, pre-eclampsia.

Cite this articleas: Shaikh S, Abbasi A, Sultana F, talpur S, Shaikh F, Anjum F. Comparison of the Spot Urine Protein Creatinine Ratio with 24 Hours Urine Protein Excretion in Women with Pre-Eclampsia. J Soc Obstet Gynaecol Pak. 2021; 11(4):269-272.

Introduction

Preeclampsia, among the most common pregnancy related hypertensive disorders, is defined by elevated blood pressure beyond 20 weeks of gestation and the presence of proteinuria for the first time.[1]Pre-eclampsia has been the most hazardous type of gestational hypertension, accounting for a quarter of all pregnancy - related deaths and serious near-miss morbidities.[2]Preeclampsia affects 3–8% among all pregnancies, posing a major threat to the wellbeing of both maternal and newborn.[3,4]Women during pregnancy with preeclampsia are at risk for organ system malfunction, which can lead to pregnancy related severe complications like retinopathy, reduced renal function, foetal growth restriction (FGR) and premature delivery.[3]Deaths caused by pre-eclampsia/eclampsia account for one-3[rd]of all maternal mortality in Pakistan's tertiary care hospitals.[5] Women having pre-eclampsia

Authorship Contribution: [1,2,3]Substantial contributions to the conception or design of the work, acquisition, analysis, or interpretation of data for the work, [4,5]Drafting the work or revising it critically for important intellectual content, , [6]Final approval of the version to be published.

Funding Source: none
Conflict of Interest: none

Received: July 24, 2021
Accepted: Jan 08, 2022

should be aware that when significant proteinuria occurs, it can lead to negative pregnancy outcomes.[3,4,6] Women with significant' proteinuria and prenatal hypertension are frequently hospitalized for monitoring until childbirth, which has consequences for therapeutic management and health-care expenditures.[5]Proteinuria must be accurately identified and quantified for the diagnosis and treatment of renal disorders, as well as the progression of chronic kidney disease (CKD).[8,9]When it comes to procedures for determining urinary protein excretion, 24-hour urine collections is regarded the gold standard. Furthermore, because of its accessibility and simplicity, the spot urine protein/creatinine ratio (UPCR) is frequently employed in recent clinical practice to quantify daily protein excretion.[8] Although proteinuria is among the most common symptoms of pre-eclampsia, while it is unclear if the intensity of proteinuria is linked to the pregnancy complications of preeclampsia cases.[4]The typical way for detecting proteinuria is to quantify urine protein following a 24-hour urine collection.[10]It takes a long time and costs a lot of money. Preeclampsia must be diagnosed as soon as possible to avoid deadly maternal and foetal consequences. Along with its excellent association rate with 24-hour urine protein, the random urine spot protein creatinine ratio is a suitable alternative diagnostic test for severe proteinuria in pre-eclampsia.[10] After taking above controversies and to assess the effectiveness of that non-invasive and quick diagnostic tool, this study has been done to assess the diagnostic accuracy of random urine protein / creatinine ratio for the prediction of significant proteinuria in women with pre-eclampsia.

Methodology:

This descriptive study was conducted in the department of Obstetrics / Gynaecology. Liaquat University Hospital (Tertiary Care Hospital) Jamshoro / Hyderabad, during six months from Oct 2015 to April 2015. Non probability convenient sampling technique was used. Patient more than 20 weeks of gestation with hypertension with all age group and parity were included. Women who have medical disorder other than Hypertension like diabetes mellitus, chronic hypertension, and chronic renal disease were excluded. All women were asked to provide a 24 Hr urine collection, The subjects were advised to pass urine at 8:00 AM and collect all urine subsequently till 8:00 AM next morning Random sample for P/C ratio collected the next morning simultaneously after 24 Hr urine collection is over. Urinary protein quantification was done by biuret method and urinary creatinine by modified Jaffe's method. The result provided by Lab were calculated to obtain ratios by principal investigator using mathematical calculation. Relevant information was recorded on predisposed Proforma including bio data specifically age, LMP, and gestational age. Diagnosed case of HTN will be selected for data entry for analysis and to determine the significance of P/C ratio. Data were entered and analyzed in statistical program SPSS version 26.0.

Results

A total of 897 24-h urine specimens were collected from pregnant women. We excluded 837 specimens (93.31%) with inadequate 24-h urine collection; 60 samples from 897 women were included in the final analysis. The mean age of women was 28.32± 4.65 years. Mean gestational age was 33.55± 4.13. Moan systolic blood pressure was 154.23 ±14.23mmHg. Mean diastolic blood pressure was 101.17 ± 7.762mmHg. Mean proteinuria was 1366.03± 1548.616 whereas mean P/C ratio was 1.91±2.48. Table I

Table I: Descriptive statistics of demographic characteristics, 24-hour urine protein and spot protein/Creatinine ration (n=60)

Variables	Statistics			
	Mean	SD	Min	Max
Age (years)	28.32	4.65	20	40
Period of gestation	33.35	4.13	15	41
Systolic blood pressure	154.23	14.23	130	200
Diastolic blood pressure	101.17	7.762	90	120
Hemoglobin	10.57	1.05	8.2	12.4
platelets (in Lacs)	1.753	0.57	0.8	3.0
Urea	21.03	2.22	15	25
24-hour urine protein	1366.03	1548.61	54.0	9616.0
Spotprotein/Creatinine ration	1.91	2.48	0.01	13.20

Out of 60 women, 16 (26.6%) women were gestational hypertensive, 26(43.3%) women were mild pro-eclamptic and 18(30.0%) women were severe pre-eclamptic. Mean of 24-hour protein and P/C ratio was 173.25± 82.8, 0.12±0012 in gestational hypertensive group, 1010.79± 457.38, 1.29 ± 0.78 in mild preeclampsia group, and 3387.00± 1867.07, 4.65±3.56 in severe preeclampsia. Table II

It was noted that the correlation coefficient at lesser degree of proteinuria (i.e. less than 300mg) was less (0.69), as compared to other two groups, but statistically significant at p value 0.044. Table III

A fair correlation coefficient of r= 0.802 was observed between the 24 hours urine protein and spot urine protein/Creatinine ratio among 60 women which was statistically significant at p value <0.001. Table IV

Table II: Mean of 24-hour urine protein and P/C ratio according to gestational HTN and sever pre-eclampsia (n=60)

Variables		Mean	SD
Gestational hypertension	24hr protein	173,2545	82.84927
	Pc ratio (n=16)	0.12	0.12
Mild pre-eclampsia	24hr protein	1010.79	457.38614
	Pc ratio (n=16)	1.29	0.78
Severe eclampsia	24hr protein	3387.00	1867.07
	Pc ratio (n=16)	4.65	3.56

Table III: Pearson's correlation coefficient between 24hr protein and P/C ratio, according gestational hypertension, mild and severe pre-eclampsia group (n=60)

Pc ratio	Protein Creatinine ratio (r value)	No. of patients	P-value
Gestational hypertension 24hr protein	0.691	16	0.044*
Mild 24hr protein	0.777	26	<0.001*
Severe pre-eclampsia 24hr protein	0.713	18	<0.001**

Table IV: Correlation coefficient between protein-creatinine ratio and 24-hour urine protein (mg)(n=60)

Karl Pearson's correlation between	Correlation Coefficient	p-value
Spot protein creatinine ratio 24 hours sample of urine protein (mg)	0.802	<0.001

Discussion

One of the most common signs of renal disease is proteinuria. Proteinuria testing is useful for establishing a diagnosis, tracking the progression of the condition, and evaluating the success of treatment.[11] In this study the mean age of women was 28.32± 4.65 years, mean gestational age was 33.55 ± 4.13, mean systolic blood pressure was 154.23 ± 14.23 mmHg, mean diastolic blood pressure was 101.17 ± 7.762 mmHg. Consistently Pasternak Y et al[12] reported that the time of the evaluation, the average gestational age was 34.0±3.4 weeks. In another study of Kim MJ et al[13] reported that mean age of the patients was 32.6±3.8 years, mean gestational age was 31.5±3.1 weeks, mean systolic blood pressure was 170.5±19.1 mmhg, mean diastolic blood pressure was 103.7±13.1 mmhg in the patients of massive proteinuria group. In the study of Shreya G et al[14] reported that the average age of the patients was 24.4 ± 3.2 years and average gestational age was 35.2 ± 3.6 weeks.

In this study the mean proteinuria was 1366.03± 1548.616 whereas mean P/C ratio was 1.91±2.48. Consistently Shreya G et al[14] reported that the pre-eclamptic women's mean 24-hour protein was 1790 0.80 mg/24-hours, and their mean P/C ratio was 1.84 0.91.Abdelazim IA et al[15] reported that the females mean 24-hour protein of 1393.5 670 mg/24-hour urine (1.393 0.67 g/24-hour urine), a spot urine protein of 157 212 mg/dL, a spot urine creatinine of 116 83.5 mg/dL, and a P/C ratio of 1.35 2.54.

In this study mean of 24-hour protein and P/C ratio was 173.25± 82.8, 0.12 ± 0012 in gestational hypertensive group, 1010.79 ± 457.38, 1.29 ± 0.78 in mild preeclampsia group, and 3387.00 ± 1867.07, 4.65 ± 3.56 in severe preeclampsia. a fair correlation coefficient of r= 0.802 was observed between the 24 hours urine protein and spot urine protein/Creatinine ratio among 60 women which was statistically significant at p value <0.001. Consistently Abdelazim IA et al[15] reported that among females having preeclampsia, the spot urine P/ C ratio and 24-hour urine protein excretion have a strong relationship and the urine P/ C ratio may be used to rule out preeclampsia. Similarly in the study of also observed that the spot urine P/C ratio is an effective, dependable, and consistent rapid, time-saving test that can be used as an alternate approach for evaluating proteinuria in gestational induced high blood pressure and can be used to replace 24-hour urinary protein excretion estimate in clinical practice. On other hand Mdunge BS et al[10] conducted the study to see if the spot urine protein-creatinine ratio may be utilized as an alternate diagnostic test for severe proteinuria in pre-eclampsia to the usual quantitative 24-hour urine protein excretion and they reported that there was a significant correlation between above tests r=0.74, P<0.001.

The (P/C ratio) is a quick and easy way of detecting and evaluating proteinuria's quantitative measurement. For substantial proteinuria in presumed pre-eclampsia, the mother "spot urine" assessment of protein to creatinine ratio indicates potential diagnostic utility.[16] Due to the variation in accuracies and incidence between studies, the present evidence is insufficient to define how protein to creatinine ratio can be used in clinical practice.[17]

Conclusion

Significant correlation coefficient was observed between the 24 hours urine protein and spot urine protein/Creatinine ratio. It was observed to be useful in an outpatient setting to predict clinically significant proteinuria and to monitor renal functions in such women with lesser degrees of proteinuria thus avoiding unnecessary Hospital admissions. Urinary excretion has considerable clinical implications in the course of pregnancy and on the perinatal and maternal outcome. For years, 24 hours urine collection has been the standard for quantitation of proteinuria in the management of women with pre-eclampsia. It is especially found to be useful in an outpatient setting to predictclinically significant proteinuria and to monitor renal functions in women with lesser degrees of proteinuria thus avoiding unnecessary hospital admissions.

References

1. Sanchez-Ramos L, Gillen G, Zamora J, Stenyakina A, Kaunitz AM. The protein-to-creatinine ratio for the prediction of significant proteinuria in patients at risk for preeclampsia: a meta-analysis. Annals of Clinical & Laboratory Science. 2013;20;43(2):211-20.
2. Magee LA, Sharma S, Sevene E, Qureshi RN, Mallapur A, Macuácua SE, Goudar S, et al. Population-level data on antenatal screening for proteinuria; India, Mozambique, Nigeria, Pakistan. Bulletin of the World Health Organization. 2020 Oct 1;98(10):661.
3. Lei T, Qiu T, Liao W, Li K, Lai X, Huang H, Yuan R, e tal. Proteinuria may be an indicator of adverse pregnancy outcomes in patients with preeclampsia: a retrospective study. Reproductive Biology and Endocrinology. 2021 Dec;19(1):1-8.
4. Lin S, Leonard D, Co MA, Mukhopadhyay D, Giri B, Perge L, et al. Pre-eclampsia has an adverse impact on maternal and fetal health. Transl Res. 2015;165(4):449–63.
5. Khowaja AR, Qureshi RN, Sheikh S, Zaidi S, Salam R, Sawchuck D, Vidler M, et al. Community's perceptions of pre-eclampsia and eclampsia in Sindh Pakistan: a qualitative study. Reproductive health. 2016 Jun;13(1):39-44.
6. Mateus J, Newman R, Sibai BM, Li Q, Barton JR, Combs CA, Guzman E, Boggess KA, Gyamfi C, von Dadelszen P, Woelkers D. Massive urinary protein excretion associated with greater neonatal risk in preeclampsia. American Journal of Perinatology Reports. 2017 Jan;7(01):e49-58.
7. Bramham K, Poli-de-Figueiredo CE, Seed PT, Briley AL, Poston L, Shennan AH, et al. Association of proteinuria threshold in pre-eclampsia with maternal and perinatal outcomes: a nested case control cohort of high risk women. PloS one. 2013 Oct 10;8(10):e76083.
8. Yang CY, Chen FA, Chen CF, Liu WS, Shih CJ, Ou SM, Yang WC, et al. Diagnostic accuracy of urine protein/creatinine ratio is influenced by urine concentration. Plos one. 2015 Sep 9;10(9):e0137460.
9. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. Am J Kidney Dis 2002 Feb;39(2 Suppl 1):S1–266
10. Mdunge BS, Baloyi SM. The accuracy of spot urine protein-to-creatinine ratio in diagnosis or exclusion of significant proteinuria in pre-eclampsia. InObstetrics and Gynaecology Forum 2021;31;1; 8-
11. Kamińska J, Dymicka-Piekarska V, Tomaszewska J, Matowicka-Karna J, Koper-Lenkiewicz OM. Diagnostic utility of protein to creatinine ratio (P/C ratio) in spot urine sample within routine clinical practice. Critical reviews in clinical laboratory sciences. 2020 Jul 3;57(5):345-64.
12. Pasternak Y, Lifshitz D, Shulman Y, Hiersch L, Rimon E, Kuperminc M, Yogev Y, et al. Diagnostic accuracy of random urinary protein-to-creatinine ratio for proteinuria in patients with suspected pre-eclampsia. Archives of Gynecology and Obstetrics. 2021 Jul;304(1):109-15.
13. Kim MJ, Kim YN, Jung EJ, Jang HR, Byun JM, Jeong DH, Sung MS, et al. Is massive proteinuria associated with maternal and fetal morbidities in preeclampsia?. Obstetrics & gynecology science. 2017 May 15;60(3):260-5.
14. Shreya G, Pranathi L, Kavitha V. Comparison of spot urine protein-creatinine ratio with 24-hour urine protein excretion in women with preeclampsia. Int J Intg Med Sci. 2015;2(1):55-9.
15. Abdelazim IA, Amer OO, Shikanova S, Karimova B. Protein/Creatinine ratio versus 24-hours urine protein in preeclampsia. Ginekologia Polska. 2022 Feb 8.
16. Jan S, Javaid C, Firdous N. Diagnostic accuracy of spot urinary protein/creatinine ratio for proteinurea in pregnancy induced hypertension. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017 May 1;6(5):2083-90.
17. Morris RK, Riley RD, Doug M, Deeks JJ, Kilby MD. Diagnostic accuracy of spot urinary protein and albumin to creatinine ratios for detection of significant proteinuria or adverse pregnancy outcome in patients with suspected pre-eclampsia: systematic review and meta-analysis. Bmj. 2012 Jul 9;345.