

“Diagnostic Use of Spot Urine Protein-Creatinine Ratio, Their Correlation in Quantification of Proteinuria in Hypertensive Pregnant Women”

Dr Siddharth Kapoor^{1*}, Dr. Kumar Vivek², Dr Govind J Sahay³

¹ Senior Resident, Department of Medicine, Rajendra Institute of Medical Sciences, Ranchi.

² MD physiology Rajendra Institute of Medical Sciences, Ranchi

³ PROFESSOR, Department of Physiology, Rajendra Institute of Medical Sciences, Ranchi

Corresponding Author: Dr Siddharth Kapoor

Abstract: objective was to study the correlation between Protein- creatinine ratio of spot urine sample. Correlation of the values in hypertensive pregnant females Implications and correlation with clinical scenario. Patient would be selected according to criteria for gestational hypertension. blood pressure determined by mercury sphygmomanometer on two occasions at least 4 hrs apart. The sample collected would be the first morning urine sample/ midstream sample. The cut off value of P/C would be fixed determined by receiver operating characteristics (ROC) curve. Observation shows mean value of serum creatinine in normal and pregnant females whose values are 0.55 ± 0.14 mg /dl and 0.77 ± 0.29 mg/dl. t value is 3.75 while p value is 0.03 and hence the value is significant in this case also. The level of serum creatinine in complicated pregnancy is more as compared to normal pregnancy. value of 24 hour urinary creatinine in normal pregnancy is 2.63 ± 53.82 while in complicated pregnancy it is 1.66 ± 35.36 . The value is significant (t-value is 9.65 and p- value is 0.02) decrease in the urinary creatinine. This decrease is due to decrease in the normal functioning of the kidney. The glomerular filtration rate and renal plasma flow is decreased leading to decrease in creatinine. The parameters would be assessed and accordingly a criteria would be established to predict course of action in patients with proteinuria and gestational hypertension and an attempt would be made to determine clinical severity.

Keywords: spot urine protein-creatinine ratio, proteinuria, gestational hypertension, preeclampsia, eclampsia

Date of Submission: 20-03-2019

Date of acceptance: 06-04-2019

I. Introduction

Hypertensive disorders in pregnancy are common and form one of the deadly triad, along with hemorrhage and infection, that contribute greatly to maternal morbidity and mortality. In 2001, according to the National Center for Health Statistics, gestational hypertension was identified in 150,000 women, or 3.7 percent of pregnancies (Martin and colleagues, 2002). An accurate and rapid detection of proteinuria is essential in the management of hypertensive disorders in pregnancy. The term *gestational hypertension* is used now to describe any form of new-onset pregnancy-related hypertension. It was adopted by the Working Group of the NHBPEP (2000), which proposed a classification system based on clinical simplicity to guide management. The term was chosen to emphasize the cause-and-effect connection between pregnancy and its unique form of hypertension—preeclampsia and eclampsia. It is also meant to be a working term that is purposefully vague, but it should convey that the development of hypertension in a previously normotensive pregnant woman should and must be considered potentially dangerous to both herself and her fetus. In the past several editions of *Williams Obstetrics*, the term *pregnancy-induced hypertension* was used. It was popularized by Dr. Jack Pritchard to convey the same principles, and it still is used by some interchangeably with gestational hypertension.

There are five types of hypertensive disease in pregnancy:

1. Gestational hypertension (formerly pregnancy-induced hypertension that includes transient hypertension).
2. Preeclampsia.
3. Eclampsia.
4. Preeclampsia superimposed on chronic hypertension.
5. Chronic hypertension.

Proteinuria (≥ 0.3 g/24 hr) is considered a late sign of pre-eclampsia, and carries a poor perinatal prognosis. A phase of microalbuminuria precedes clinical proteinuria and that this test has some predictive value for severe disease. Extensive changes occur in the renal system in pre-eclampsia. As part of the “end

organ pathology” preeclamptic glomeruli undergo structural changes with pronounced endothelial vacuolisation and hypertrophy of the cytoplasmic organelles first defined as glomerular endotheliosis . Although it is now accepted that proteinuria is not inevitable in preeclampsia it still remains a cardinal sign of the syndrome and one of the two features, along with hypertension that clinicians use to screen the pregnant population for early detection of the disease.

In pregnancy proteinuria is usually detected and measured either by visual dipstick urine test or by the 24hrs urinary protein measurement. The visual dipstick urine test serves as a rapid bedside screening test in the initial evaluation of proteinuria. But recent studies have found it to be inaccurate, giving a high number of false positive and false negative results. The 24hrs urine collection has been the gold standard in most places for quantifying proteinuria. Though a reliable indicator, it has the disadvantage of being a cumbersome and time consuming process, for both the patient and laboratory(9). It is subject to collection errors requires good patient compliance and there is a delay of 24hrs from the time of collection until the diagnosis is made. The protein-creatinine ratio in a single urine specimen has been used for rapid and accurate detection of proteinuria in hypertensive pregnant women(7). It avoids collection error and gives physiologically more relevant information. Hence, there is a need to evaluate these tests which can be used to quantify the proteinuria accurately and rapidly in out patient settings, overcoming the limitations of routinely performed tests.(9) Several studies have been conducted in the past which indicate that protein-creatinine ratio give a fairly accurate result as predictors of quantitation of proteinuria. This is an ongoing discussion as to replace the parameter of P/C ratio as gold standard for detection of proteinuria. A similar research by Leanos Miranda et al(11) also deduced that P/C ratio is a reliable marker of proteinuria over 24 hr sample. Also a study done earlier on cases of lupus nephritis also stressed on this test for follow up of the patients(12).

Objectives

To study the correlation between

1. Protein –creatinine ratio of spot urine sample.
2. Correlation of the values in hypertensive pregnant females
3. Implications and correlation with clinical scenario

II. Materials And Methodology

Patient would be selected according to criteria for gestational hypertension blood pressure determined by mercury sphygmomanometer on two occasions atleast 4 hrs apart. The sample collected would be the first morning urine sample/ mid stream sample. The cut off value of P/C would be fixed determined by receiver operating characteristics (ROC) curve. A case would be defined as, systolic BP more than /equal to 140 mm of Hg and /or diastolic BP Greater than or equal to 90 mm of Hg and pregnant females more than 20 weeks of gestation. Excluded case would be subject not giving consent and medically unstable patient. The data would be collected , compiled and analysed to establish an association between the different parameters in hypertensive pregnant females.

III. Results

TABLE 1: SERUM CREATININE LEVELS IN PREGNANT FEMALES

	Normal Pregnancy	Complicated Pregnancy	t-Value	p - Value
Serum Creatinine (mg/dl)	0.55±0.14	0.77±0.29	3.75 (df – 78)	0.03

The above table shows mean value of serum creatinine in normal and pregnant females whose values are 0.55±0.14 mg /dl and 0.77±0.29 mg/dl. t value is 3.75 while p value is 0.03 and hence the value is significant in this case also. The level of serum creatinine in complicated pregnancy is more as compared to normal pregnancy as we can see in the table above.

FIG 1: VARIATION OF SERUM CREATININE IN NORMALE AND COMPLICATED PREGNANCY

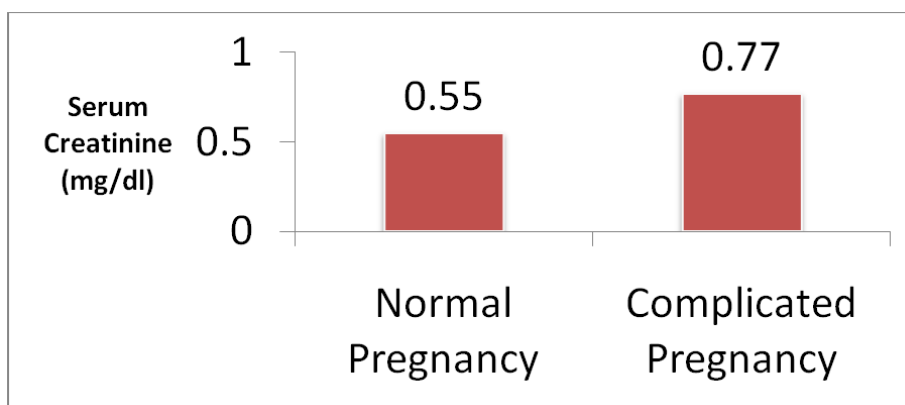


TABLE 2 : Spot Urine Protein/Creatinine Ratio

	Normal Pregnancy	Complicated Pregnancy	t-Value	p - Value
Spot Urine Protein/Creatinine Ratio	0.39±2.1	0.58±0.5	0.08 (df - 78)	0.08

Table above shows the value of spot urinary protein /creatinine ratio in normal and complicated pregnancy. In normal pregnancy the ratio is 0.39 ± 2.1 , where as in complicate pregnancy it is 0.58 ± 0.5 . t –value is 0.08 and p value is 0.08. protein/creatinine ratio is high in complicated pregnancy because, there is greater proteinurea and there is lesser excretion of creatinine due to defect in the normal physiological function of the kidney .In normal pregnancy the glomerular filtration rate and renal plasma flow increase so the ratio is not increased that much.

FIG 2: SPOT URINEPROTEIN/CREATININE RATIO IN PREGNANCY

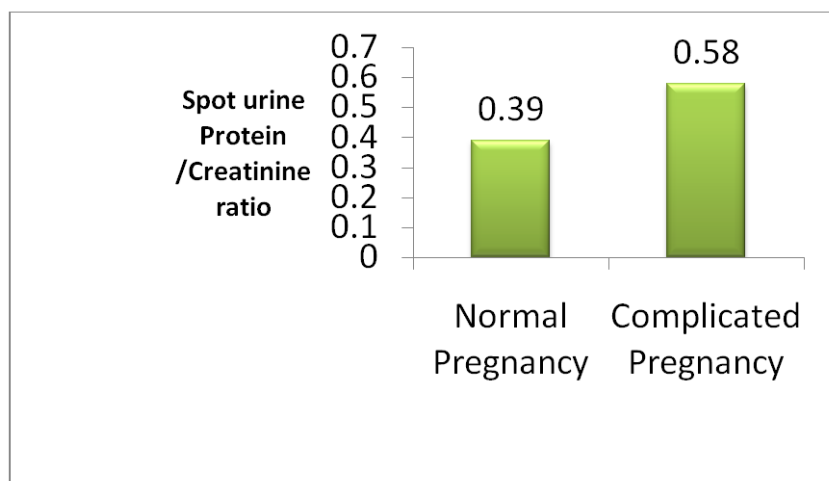


Table 3 : 24Hr URINARY CREATININE IN PREGNANT FEMALES

	Normal Pregnancy	Complicated Pregnancy	t-Value	p - Value
24Hr Urinary Creatinine(mg)	2.63±53.82	1.66±35.36	9.65 (df - 78)	0.02

In the table given above, we find the value of 24 hour urinary creatinine in normal pregnancy is 2.63 ± 53.82 while in complicated pregnancy it is 1.66 ± 35.36 . The value is significant (t-value is 9.65 and p- value is 0.02) decrease in the urinary creatinine. This decrease is due to decrease in the normal functioning of the kidney. The glomerular filtration rate and renal plasma flow is decreased leading to decrease in creatinine.

FIG 3: 24 HR URINARY CREATININE IN PREGNANT FEMALES

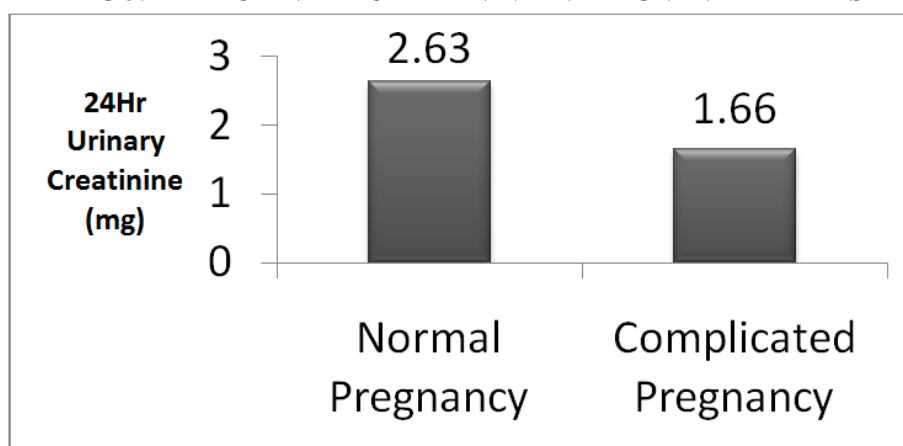
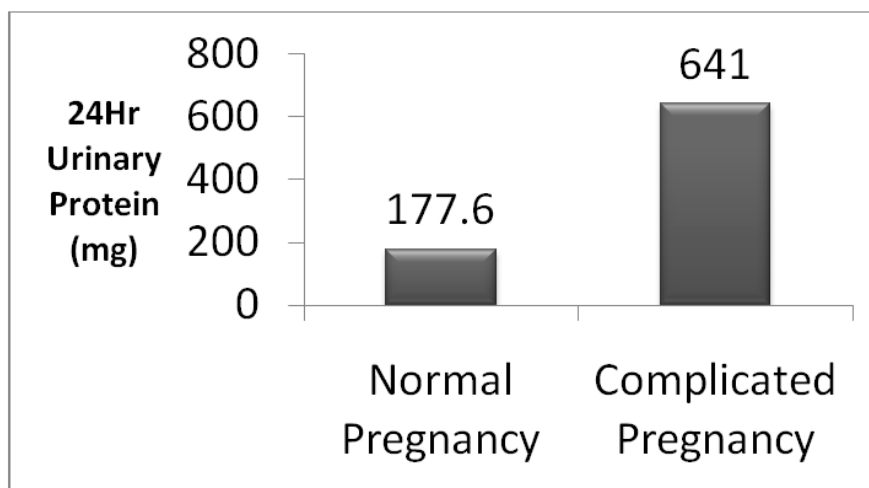


TABLE 4 :24Hr URINARY PROTEIN IN PREGNANT FEMALES

	Normal Pregnancy	Complicated Pregnancy	t-Value	p - Value
24Hr Urinary Protein (mg)	177.60±32.65	641±237.46	10.60 (df – 78)	0.010

The table above shows value of 24 hr urinary protein in normal pregnancy is 177.60±32.65 mg and in complicated pregnancy it is 641±237.46mg. The value is significant as t- value for the table is 10.60 while p value is 0.01. High blood pressure causes damage to the kidney and hence proteinuria.

FIG 4 : 24 HR URINARY PROTEIN IN PREGNANT FEMALES



IV. Discussions

1. Mean Systolic and Diastolic blood pressure in Hypertensive pregnant female was found to be 144.96mm Hg and 100.64 mm Hg, indicating Preeclamptic condition.
2. The Random Blood Sugar in Hypertensive pregnant female of greater than 20 weeks of gestation was 119.2 mg/dl.
3. The mean value of Serum Creatinine level in normal pregnancy was 0.55 mg/dl and in Hypertensive pregnant female was 0.77 mg/dl.
4. The mean level of blood urea in Hypertensive pregnant female was found to be 38.3 mg while in normal pregnancy, the value was 12.4 mg.
6. Spot urine protein/creatinine ratio was found to be 0.58 in Hypertensive pregnant female (p – value – 0.04) indicating proteinuria and thus diagnostic of Preeclamptic condition whereas the value in normal pregnancy was 0.39.

7. The mean level of Uric acid in Hypertensive pregnant female was found to be 5.6 mg/dl whereas in normal pregnancy, the value was 3.2mg/dl. The p-value for the given data was significant (0.01). Increase in uric acid level is also diagnostic of preeclamptic condition.
8. The mean level of Urinary creatinine in Hypertensive pregnant female was 1.16 mg and in normal pregnancy was 2.63 mg.
9. The mean level of 24 hr Urinary protein in Hypertensive pregnant female was 641 mg whereas in normal pregnancy, it was 177 mg. This massive proteinuria in Hypertensive pregnant female is also indicative of Preeclamptic condition.(p – value – 0.01)/
10. The ROC curve for the given data shows Area under curve was 0.937 and P- value was $\lt; 0.01$.
11. The Sensitivity was observed to 98% and Specificity was 83.3%. Protein/creatinine ratio was at a value of 0.25.
12. The positive predictive value for the data was 96.15% and negative predictive value was 90.74%.

V. Conclusion

The parameters would be assessed and accordingly a criteria would be established to predict course of action in patients with proteinuria and gestational hypertension and an attempt would be made to determine clinical severity.

References

TEXT BOOKS

- [1]. Review of medical physiology: W.F.Ganong 21st edition
- [2]. Text Book of Medical Physiology Guyton And Hall 12th edition
- [3]. Harrison’s Principle of Internal Medicine 18th edition
- [4]. William’s Obstetrics 22nd edition

Journals and research papers

- [1]. Clinical Obstetrics and Gynaecology, vol.35, No.2, June 1992,338-347.
- [2]. Walsh SW: Pre eclampsia: An imbalance in placental prostacyclin and thromboxane production, Am J.Obstet Gynecol, 1985, vol 152: 335.
- [3]. Nova A, Sibai B M, Barton JR et al: Maternal Plasma Level of Endothelin is increased in Pre. clampsia Am J Obstet Gynecol, 1991,vol 165: 724.
- [4]. Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Rouse DJ, Spong CY. Williams Obstetrics. 23rd d. McGraw- Hill Medical Publishing Division; 2010.p. 706-56.
- [5]. Davey DA, Macgillivray I. The Classification and definition of the hypertensive disorders of pregnancy. Am J Obstet Gynecol 1988; 158: 892-98.
- [6]. Phelan LK, Brown MA, Davis GK, Mangos G. A prospective study of the impact of automated dipstick urinalysis on the diagnosis of pre-eclampsia. Hypertens Pregnancy
- [7]. Papanna R,Mann LK, Kouides RW et al. Protein/Creatinine ratio in pre eclampsia :A systematic review. Obstet Gynecol 2008; 112: 135.
- [8]. Brown MA, Lindheimer MD, DeSwiet M, vanAssche A, Moutquin JM. The classification and diagnosis of the hypertensive disorders of pregnancy: statement from the International Society for the Study of Hypertension in pregnancy (ISSHP).
- [9]. Lemann JJ, Doumas BT. Proteinuria in health and disease assessed by measuring the urinary protein/creatinine ratio.
- [10]. Tamura S, Shimizu T, Kawakatsu H, Tateishi S. Correlation between 24- hour urine protein excretion and Protein/creatinine ratio in the first voided morning urine samples.
- [11]. Leanos-Miranda A, Marquez-Acosta J, Romero-Arauz F, Cardenas-Mondragon GM, Rivera-Leanos R, Isordia-Salas I, Ulloa-Aguirre A. Protein:creatinine ratio in random urine samples is a reliable marker of increased 24-hour protein excretion in hospitalized women with hypertensive disorders of pregnancy. Clin Chem. 2007;53(9):1623–1628. [PubMed] Sessoms S, Mehta K, Kowarsky J. Quantitation of proteinuria in systemic lupus erythematosus by use of a random urine spot collection. Arthritis Rheum. 1983;26:918–920

Dr Siddharth Kapoor. “Diagnostic Use of Spot Urine Protein-Creatinine Ratio, Their Correlation in Quantification of Proteinuria in Hypertensive Pregnant Women.” IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 04, 2019, pp 32-36.