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Anticipating Pre-Eclampsia by the Assessment of the Spot Urine Albumin-To-Creatinine Ratio in Early Gestation

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KEYWORDS

Preeclampsia, Spot Albumin-Creatinine Ratio (ACR), Early Gestation

ABSTRACT:

Objectives: Evaluation of the spot urinary albumin-to-creatinine ratio for identifying pre- eclampsia between 20 and 28 weeks of gestation.

Study Design: Prospective observational study.

Material and Methods: In our study we included 40 pregnant women between 20 and 28 weeks of gestation, having singleton pregnancies with normal renal function, who attended the out patients Department of O&G, VIMSAR, Burla. Albumin and creatinine were estimated by auto analyser (Hitachi, Cobas c 311, Roche Diagnostics GmbH, Germany).

Result: The spot ACR ≥35.5 mg/mol yield a sensitivity of 87.71%, specificity of 95.28%, positive predictive value of 75%, and negative predictive value of 97.41% for predicting pre- eclampsia.

Conclusions: The study shown that, the asymptomatic women with eminent spot urinary ACR values in early pregnancy were more likely to develop pre-eclampsia in lateral stage. During second trimester the level of ACR level ≥35.5 mg/mmol predicted pre-eclampsia effectively before symptoms appeared. So it acts like a paradigm for assessment of this disease.

Introduction:

Pregnancy-specific hypertensive complaint usually happening after 20 weeks of gestation is known as pre-eclampsia. This is a disorder that affects many systems and has an unidentified cause. This problem arises, when a pregnant woman having normal blood pressure and no proteinuria starts to have blood pressure >140/90 mm Hg after 20 weeks of gestation. Pre- eclampsia has been linked to preterm birth, intrauterine growth retardation, and maternal and perinatal death [1]. From the earlier study it was found that about 12–18% of pregnancy- related deaths, and it is the second leading cause of maternal mortality is due to pre-eclampsia [2]. Epidemiological data suggests an incidence of pre-eclampsia ranging from 4-18% mostly in low-resource countries [3]. One of the serious and direct causes of mother and child mortality and morbidity is eclampsia, which can result from preeclampsia if it is not identified early. From the previous report it is found that pre-eclampsia and other hypertension diseases complication is 5–10% [4]. Maternal symptoms such as antepartum

and postpartum hemorrhage, eclamptic seizures, hepatic failure, acute renal failure, stroke, placental abruption, HELLP syndrome, heart failure and multiorgan failures, are results from pre-eclampsia. Fetal inconvenience such as fetal discomfort, intrauterine growth retardation, neonatal hypoxia, premature birth, stillbirth, and perinatal death may also result from it if treatment is delayed. Pre-eclampsia endure as a significant community health issue in both industrialized and developing nations. According to the WHO estimations, pre-eclampsia is seven times more common in developing nations than in industrialized ones [5]. If the patients persistent microalbuminuria, it's a good sign that you might be developing PE during pregnancy and a sign that your kidneys may not be able to do their job properly. Despite being the gold standard for measuring urinary albumin excretion, 24-hour urine collection is laborious and causes a minimum 24-hour delay in diagnosis [6]. Assuming that microalbuminuria appears prior to proteinuria, numerous earlier research studies have examined microalbuminuria in an effort to predict pre-eclampsia in the early stages of pregnancy. The current study aims to determine spot urine albumin-to-creatinine ratio is also helps to predicts pre-eclampsia in asymptomatic pregnant women during the early stages of pregnancy.

Materials and Methods

The prospective observational study included forty singleton (pregnancies) women who attending tertiary care center, VIMSAR, Burla, Sambalpur, Odisha, India, between 20 and 28 weeks of gestation. The study was conducted for two months from November 2024 to January 2025 after approved by the institutional ethical committee. The written informed consent was obtained from all participating women.

The data collection for cases were obtained thrice weekly from the labor room of the O&G Department. On each day of data collection, a maximum of two-three pre-eclampsia patients satisfying inclusion criteria were selected for our study and register them in the labor room and were enrolled as study subjects. Data such as (name, age, address, registration details), disease details, and previous treatment were collected. Control were also selected randomly from labor room three times a week, with a maximum of two controls selected on each day of data collection. Blood pressure was measured in the right arm of the patient in a semi- recumbent position with a left lateral tilt. Albumin and creatinine were estimated by auto analyzer (Hitachi, cobas c 311, Roche Diagnostics GmbH, Germany). For each test a small amount of midstream urine was used. All subjects were followed until delivery. Based on established criteria, participants were classified into two groups: those who developed preeclampsia and those who remained normotensive throughout the study period. According to a previous study by Baweja et al. [7], the cut-off value of ACR (mmol of albumin/mg of creatinine) was 35.5 mg/mmol. ACR was calculated, and those with a ratio equal to or more than 35.5 mg/mmol were considered test positive. Those with a ratio of less than 35.5 mg/mmol were considered test negative.

Inclusion criteria: Pregnant women diagnosed with pre-eclampsia after the 20th week of gestation, i.e., blood pressure ≥ 140/90 mm Hg were included as a case. Controls included all pregnant women admitted to the labor room after the 20th week of gestation and not identified with pre-eclampsia.

Exclusion criteria: Seriously ill and cognitively impaired and had a history of cardiovascular diseases, endocrine diseases, autoimmune diseases, renal diseases, AIDS, and cancer pregnant women were excluded from the study.

Statistical Analysis: Recorded data were entered, checked, and analyzed using SPSS version

21.0 (SPSS IBM Corporation, Armonk, New York). Quantitative data were expressed as a mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage, whereas skewed data were expressed as median and range. Unpaired student's t-test was carried out for the significant value. A chi-square test was done to analyze the association between two variables, p-value < 0.05 was considered to be significant.

Results: A total of 40 women were involved in the study group. The mean age of the normotensive and pre-eclamptic patients included in the study were 27.68 ± 3.15 years and 21.52±4.85. Among normotensive 11 (55%) patients were primipara and 9 (45%) were multipara. But in case of pre-eclamptic patients 7 (35%) were primipara and rest were multipara 13(65%) The

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mean BMI were 25.6± 2.5 kg/m^2 and 21.38±4.6 in normotensive and pre-eclamptic respondents. At the time of delivery, the mean systolic blood pressure (SBP) in normotensive and pre-eclamptic women was 115.14 ± 8.45 and 158.87±5.84mmHg, respectively, and the mean diastolic blood pressure(DBP) in normotensive and pre-eclamptic women recorded were65.12±8.21and 95.14±3.54mmHg respectively as shown in Table 1.

Table-1 Medical and obstetric factors of the study groups

Parameters	Normotensive (N = 20)	Pre-eclamptic (N = 20)	P-value
Mean age in year	27.68± 3.15	21.52±4.85	0.062
Patients of primipara	11(55%)	7(35%)	NA
Patients of multipara	9(45%)	13(65%)	NA
mean BMI (kg/m^2)	25.6±2.5	21.38±4.6	0.231
mean SBP (mmHg)	115.14±8.45	158.87±5.84	0.045*
mean DBP (mmHg)	65.12±8.21	95.14±3.54	0.037*

***<0.05 statistically significant, NA- Not applied**

The distribution of spot urinary ACR among normotensive and pre eclamptic women was depicted in table-2. The ACR value of Pre-eclamptic subjects was comparatively higher than that of the normotensives subjects and have higher statistically significant difference (p- value=0.021) at p<0.05. The cut off value of ACR was taken as 35.5 mg/mmol as in previous study [9].

Table 2 Distribution of spot urinary ACR among normotensive and pre-eclamptic women

Spot Urinary ACR	Normotensive (N = 20)	Pre-eclamptic (N = 20)
Mean ± SD	15.26 ± 3.19	56.85 ± 20.88
Range	6.38, 39	28.94, 91.75
Median	11.03	61.65
P -value	0.043*	0.021*

***<0.05 statistically significant**

Association of ACR with pre-eclampsia the number of women according to test positivity and negativity was shown in Table 3. Among total 11 ACR positive cases, 3 (7.5%) women were normotensive, 8 (20%) women developed Pre-eclampsia later on in pregnancy. And out of 29 negative cases women with normotensive were 27(67.5%) and only 2 (5%) women developed Pre-eclampsia with a relative risk of 0.2929, the 95% confidence interval was (0.110-0.7730) and highly significant at p<0.0001. For pre-eclampsia screening, in early pregnancy, spot ACR cut-off ≥35.5 mg/mol was taken where we found sensitivity 87.71%, specificity was 95.28%, PPV and NPV were 75% and 97.41% respectively.

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Table 3 Association of urine (ACR) with Normotensive and pre-eclampsia patients

UACR (≥35.5 mg/mmol)	Normotensive (N)%	Pre- eclampsia (N)%	Total (N)%	Relative Risk	95% confidence interval	Chi-square (P-value)
Test positive	3(7.5)	8(20)	11(27.5)	0.2929	0.110-0.7730	<0.0001
Test negative	27(67.5)	2(5)	29(72.5)			
Total	30(75)	10(25)	40(100)			

Discussion

Pre-eclampsia (PE) and eclampsia are two of the hypertensive disorders of pregnancy that have the greatest effects on the morbidity and mortality of both the mother and the unborn child. Renal injury in PE is evaluated by measuring proteinuria. The spot urine albumin creatinine ratio (UACR) is a quick and accurate. Therefore; the current investigation was carried out at our tertiary care centre to evaluate the obstetric result in prenatal women with PE and to determine the accuracy of spot UACR in pregnant women to diagnosis PE. Previous studies have shown that the altered angiogenic system at 22 weeks of pregnancy, where endothelial dysfunction might occur, is the cause of pre-eclampsia's inadequate cytotrophoblast invasion [8]. By this point, endothelial dysfunction marker such as microalbuminuria may also be visible, while at a level it is not detectable by immunochemical techniques. Even though a 24-h collection of urine for assessment of albumin is the gold standard, a single spot urinary ACR was also used in this study because it is more practicable in clinical practice as a screening test and 24-h collection would have been more laborious and unwieldy. Not all past research have shown an any correlation between a spot urinary ACR and albumin excretion in a 24-h urine sample in normal pregnancy and pre-eclamp

We found that the spot urinary ACR at 20–28 weeks of gestation was significantly higher in women who subsequently developed pre-eclampsia with mean value of 56.85 ± 20.88 mg/mmol and then in those who remain normotensive with mean value of 15.26 ± 3.19 mg/mmol. According to the study of Baweja et al. 2011 [10] and Fatema et al 2011. [11] found the similar results in their studies.

The sensitivity of ACR at cut-off value of ≥ 35.5 mg/mmol as screening test to predict pre- eclampsia in our study was found to be 88.7% which is comparable to the studies done by Baweja et al.2011 [10] (83.3%) and Fatema et al.2011 [11] (80%). The specificity (94.20%), Positive predictive value (PPV) (79.98%) and negative predictive value (NPV) (96.01%) derived in our study are high and can be compared to the earlier studies [12]. which is similar to a study given by Mahesh et al.2020 and Modak et al. 2019 that demonstrated sensitivity of 95% and 80%, respectively, and specificity of 80% and 94.06%, respectively [13 and 14]. According to Shaarawy and Salem 2011 [15] found that at 10–12 weeks of gestation the microalbuminuria had 50% sensitivity, specificity 58%, PPV 50% and a 91% NPV for the later development of pre-eclampsia. These statistical analysis shows that spot urinary ACR has good analytical role as screening test for pre-eclampsia in early pregnancy. Therefore, spot urinary albumin/creatinine ratio (ACR) has been used in various studies [16]. Hence,

based on the studies it can be concluded that spot UACR is a reliable, fast, and precise method for identifying proteinuria in PE. This method may facilitate enhanced management of preeclamptic women, and lowering maternal and perinatal morbidity and mortality with low-resource settings in all the healthcare centre of India.

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Conclusion:

Our findings suggest that elevated spot urinary ACR values in early pregnancy among asymptomatic women may indicate an increased risk of developing preeclampsia later in gestation. Thus, identifying risk factors in preeclampsia patients between 20 and 28 weeks of gestation remains essential. Prioritizing care for high-risk mothers and enhancing antenatal care may help minimize complications and prevent maternal deaths associated with hypertensive disorders of pregnancy. Therefore, spot UACR appears as reliable, faster, and more accurate method for early diagnosis and timely management, which crucial for reducing maternal and foetal mortality and morbidity. Spot UACR testing is effective for identifying high-risk mothers early in their pregnancy, allowing for prompt intervention and monitoring. Early diagnosis and management are essential for preventing adverse outcomes in women at risk for pre-eclampsia, making spot UACR an invaluable tool in antenatal care.

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Authors contribution: PP, SB, OP and MP designed the research, PP, SB and MP carried out all laboratory investigations, MP, SM and SB analyzed the data PP, SB and MP wrote the manuscript, All the authors approved the final version of the manuscript.

Conflicts of interest

There are no conflicts of interest.

References-

[1] Sibai B, Dekker G, Kupferminc M: Pre-eclampsia. Lancet. 2005, 365:785-99. 10.1016/S0140-6736(05)17987-2

[2] Kliman HJ. Uteroplacental blood flow the story of decidualization, menstruation and trophoblast invasion. Am J Pathol. 2011; 157:1759–68.

[3] Kozer E, Costei AM, Boskovic R, et al. Effects of aspirin con sumption during pregnancy on pregnancy outcomes: meta-anal ysis. Birth Defects Res Part B Dev ReprodToxicol. 2013; 68:70–84.

[4] Goyal D, Bhati I, Rana S: Determinants of pre-eclampsia at a tertiary care hospital. IOSR Journal of Dental and Medical Sciences [Internet. 2020, 19:56-61.

[5] Too far to walk: maternal mortality in context. Thaddeus S, Maine D. Soc Sci Med. 1994;38:1091–1110. doi: 10.1016/0277-9536(94)90226-7.

[6] Bar J, Kaplan B, Wittenberg C, Erman A, Boner G, Ben-Rafael Z, Hod M. Microalbuminuria after pregnancy complicated by pre-eclampsia. Nephrol Dial Transplant. 1999 May;14(5):1129-32. doi: 10.1093/ndt/14.5.1129. PMID: 10344350.

[7] Yuyun MF, Khaw KT, Luben R, et al. Microalbuminuria independently predicts all-cause and cardiovascular mortality in a British population: the European prospective investigation into cancer in Norfolk (EPIC-Norfolk) population study. Int J Epi demiol. 2014; 33:189–98.

[8] Young BC, Levine RJ, Karumanchi SA. Pathogenesis of preeclampsia. Annu Rev Pathol. 2012; 5:173–92.

[9] Risberg A, Larsson A, Olsson K, et al. Relationship between urinary albumin and albumin/creatinine ratio during normal pregnancy and preeclampsia. Scand J Clin Lab Invest. 2014; 64:17–24.

[10] Baweja S, Kent A, Masterson R, et al. Prediction of pre-eclampsia in early pregnancy by estimating the spot urinary albumin:creatinine ratio using high-performance liquid chromatography. BJOG.

2011; 118:1126–32.

[11] Fatema K, Khatun M, Akter S, et al. Role of urinary albumin in the prediction of preeclampsia. J Faridpur Med Coll. 2011;6(1):14–8.

[12] Nisell H, Trygg M, Back R. Urine albumin/creatinine ratio for the assessment of albuminuria in pregnancy hypertension. Acta Obstet Gynecol. 2012; 85:1327–30.

[13] Mahesh S, Borgohain D: Spot urinary albumin-to-creatinine ratio: a novel marker for detecting fetomaternal outcomes and complications in preeclamptic women. J ObstetGynaecol India. 2020, 70:30-5. 10.1007/s13224-019-01264-w

[14] Modak R, Das A, Pal A, Ray DK, Pal A: Evaluation of spot urinary protein-creatinine ratio as a predictor of preeclampsia. Int J Clin ObstetGynaecol. 2019, 3:290-3. 10.33545/gynae.2019.v3.i6e.428

[15] Shaarawy M, Salem ME. The clinical value of micro transferrin and microalbuminuria in the prediction of preeclampsia. Clin Chem Lab Med. 2011; 39:29–34

[16] Sanchez-Ramos L, Gillen G, Zamora J, et al. The protein-to creatinine ratio for the prediction of significant proteinuria in patients at risk for preeclampsia: a meta-analysis. Ann Clin Lab Sci. 2013;43(2):211–20.