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Original Research Article

Improving efficiency in preeclampsia diagnosis: spot urinary protein/creatinine ratio

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ABSTRACT

Background: Preeclampsia poses significant challenges to maternal healthcare due to its potential complications. Timely and accurate diagnosis is crucial for maternal and fetal well-being. Traditional methods like the 24-hour urine collection for assessing proteinuria have limitations. The spot urinary protein/creatinine ratio offers a quicker alternative, but its clinical significance remains underexplored.
Methods: This cross-sectional study, conducted from July 1, 2018, to June 30, 2019, aimed to compare the spot urinary protein/creatinine ratio with the conventional 24-hour urine protein collection method in pregnant women with preeclampsia. A total of 90 inpatients were included, meeting specific inclusion and exclusion criteria.
Results: In our study, 6.66% of subjects exhibited abnormal fundus examination findings, lower than a similar study (13%). No subjects had papilloedema, and conservatively managed abnormalities were comparable between studies. The mean urine protein creatinine ratio in our study was 1.75±2.32.
Conclusions: This study highlights the potential of the spot urinary protein/creatinine ratio as an efficient diagnostic tool for preeclampsia at Kamla Nehru State Hospital for Mother and Child. Swift identification of significant proteinuria can streamline patient care, benefiting maternal and fetal outcomes in resource-constrained healthcare settings.

Keywords: Diagnosis, Maternal healthcare, Patient care optimization, Preeclampsia, Proteinuria, Spot urinary protein/creatinine ratio

INTRODUCTION

Preeclampsia, a pregnancy-specific syndrome characterized by hypertension and proteinuria, remains a significant challenge in maternal healthcare. The timely and accurate diagnosis of this condition is paramount for ensuring the well-being of both the expectant mother and her unborn child. Traditional methods for assessing proteinuria, such as the laborious 24-hour urine collection, have limitations that hinder swift diagnosis and treatment.[1]

In many healthcare institutions, especially those where women with suspected preeclampsia are hospitalized, the ability to identify significant proteinuria rapidly can streamline patient care. One promising method for achieving this is the spot urinary protein/creatinine ratio, which offers a quick and convenient alternative to the 24-hour urine collection. Despite its potential advantages, the clinical significance of this method in certain healthcare settings remains underexplored.[2]

Kamla Nehru State Hospital for Mother and Child, like many healthcare institutions, has yet to fully investigate the utility of the spot urinary protein/creatinine ratio in the context of preeclampsia diagnosis. As such, there is a

critical need to assess its accuracy and effectiveness in this specific setting.[3]

This study aims to bridge this knowledge gap by evaluating the spot urinary protein/creatinine ratio as a diagnostic tool for preeclampsia in the context of Kamla Nehru State Hospital for Mother and Child. Our goal is to determine whether this method can offer swift identification of women with significant proteinuria, enabling outpatient care and streamlining the clinical management of suspected preeclampsia cases.[4]

In the forthcoming sections, we will elucidate our study's methodology, present the results, engage in a comprehensive discussion, and draw meaningful conclusions. Through empirical evidence and careful analysis, we seek to provide valuable insights for healthcare practitioners and institutions striving to optimize preeclampsia diagnosis and, consequently, enhance maternal and fetal outcomes.[5]

Our aspiration is that this study will not only contribute to the body of knowledge regarding preeclampsia diagnosis but also empower healthcare providers with a practical and efficient tool to improve patient care, particularly for pregnant women at risk of this formidable condition.[6]

This study aimed to assess the efficiency of the spot urinary protein/creatinine ratio as a diagnostic tool for preeclampsia in pregnant women. The primary objective is to compare this ratio with the conventional 24-hour urine protein collection method, evaluating their diagnostic accuracy in identifying significant proteinuria. The study seeks to determine whether the spot ratio can offer a quicker and practical alternative for preeclampsia diagnosis, potentially streamlining patient care and improving maternal and fetal outcomes in resource-constrained healthcare settings. Through comprehensive analysis and comparison with existing studies, the research aims to contribute valuable insights to healthcare practitioners, facilitating the optimization of preeclampsia diagnosis and enhancing patient care in obstetric settings.

METHODS

Study design and subjects

This study employed a cross-sectional design to compare the utility of the spot urinary protein/creatinine ratio with the conventional 24-hour urine protein collection method for the estimation of proteinuria in pregnant women with preeclampsia. The study was conducted in the Department of Obstetrics and Gynecology at Kamla Nehru State Hospital for Mother and Child, spanning from July 1, 2018, to June 30, 2019. The study involved a total of 90 in patients who were admitted to the antenatal ward or the labor room of the Department of Obstetrics and Gynecology. Selection criteria for the participants were defined as follows.

Inclusion criteria

Women between the ages of 18 and 40 were considered eligible. Gestational age had to be greater than 20 weeks, determined either from the first day of the last menstrual period or through 1st trimester ultrasonography. Additionally, participants needed to have a confirmed diagnosis of elevated blood pressure, specifically with readings equal to or exceeding 140/90 mmHg on at least two separate occasions. These blood pressure measurements were taken in a sitting position, with a minimum 4-hour interval between each measurement, using an appropriately sized cuff. Furthermore, the diagnosis was based on the Korotkoff phase V, which signifies the disappearance of sound as diastolic blood pressure. These stringent inclusion criteria were set to ensure the inclusion of pregnant women with preeclampsia, enhancing the accuracy and relevance of the study results.

Exclusion criteria

Exclude individuals with specific medical histories or conditions. Participants with a history of chronic hypertension and proteinuria before conception or the development of hypertension before 20 weeks of gestation were excluded from the study. Additionally, individuals with known chronic renal disease were not included, along with those who had a history of recurrent urinary tract infections. Another criterion for exclusion was applied to patients who required delivery before completing the collection of the 24-hour urine sample. These exclusion criteria were established to ensure a more homogeneous study population and to mitigate confounding factors that could affect the accuracy and reliability of the research findings.

Method of study

Patients provided informed consent, and their medical history was documented, including preeclampsia symptoms. Anthropometric data and general physical exams were conducted. Pregnancy and hypertension tests were performed. Patients collected 24-hour urine samples, and a single voided urine sample for the spot urinary protein/creatinine ratio was obtained. Urine protein and creatinine levels were measured via spectrophotometry, and the ratio was calculated using an automated spectrophotometry analyzer. This comprehensive approach ensured accurate data collection for comparing proteinuria assessment methods.

Statistical analysis

Statistical analysis evaluated the spot urinary protein/creatinine ratio's diagnostic accuracy compared to the 24-hour urine method. Sensitivity, specificity, predictive values, ROC curves, and Pearson correlation were employed. SPSS software was used for statistical analyses.

RESULTS

Table 1 provides demographic and clinical information for a study conducted between July 2018 and June 2019 on a total population of 90 individuals meeting specific inclusion criteria, including age (18-40 years), gestation age (>20 weeks), and a diagnosis of hypertension with proteinuria (BP ≥140/90 mmHg). Exclusion criteria comprised chronic hypertension, chronic renal disease, recurrent urinary tract infections, and the need for early delivery.

Table 1: Demographic distribution.

Category	Data
Total study population	90
Study period	July 2018 - June 2019
Inclusion criteria	- Age: 18 to 40 years - Gestation age >20 weeks - Diagnosis of hypertension (BP ≥140/90 mmHg) with proteinuria
Exclusion criteria	- History of chronic hypertension - Known chronic renal disease - History of recurrent urinary tract infection - Patients requiring delivery before 24-hour urine sample completion
Sociodemographic information	- Majority were multigravida (65.55%) - Primigravida (45.55%) - Multigravida (65.55%)
Mean age	28.9±5 years
Mean gestational age	31.1 weeks
Blood pressure (mmHg)	- Mean systolic: 146.89±11.61 mmHg - Mean diastolic: 94.98±8.54 mmHg
Platelet count	- < 1,00,000 /mm³: 7.77% - > 1,00,000/mm³: 83.88%
Renal function (mg/dl)	- Mean blood urea nitrogen: 11.21±3.7 mg/dl - Mean serum creatinine:0.82±0.6 mg/dl
Proteinuria evaluation	- Urine protein creatinine ratio (mean): 1.74±2.32 - Optimal threshold for proteinuria: 0.30
Sensitivity and specificity	- Sensitivity: 100% - Specificity: 87.9% - Positive predictive value: 90.4% - Negative predictive value: 92%
Additional information	- Pre-eclampsia defined as hypertension (systolic ≥ 140 mmHg and/or diastolic ≥ 90 mmHg) with significant proteinuria (>300 mg in a 24-hour collection)
Diagnostic tests for proteinuria	- Urine dipstick analysis - 24-Hour urine protein collection - Urine protein creatinine ratio (UPCR)

The majority of participants were multigravida (65.55%), with an average age of 28.9 years and a mean gestational age of 31.1 weeks. Blood pressure measurements indicated a mean systolic of 146.89 mmHg and a mean diastolic of 94.98 mmHg. Platelet count revealed 7.77% below 1,00,000/mm³ and 83.88% above. Renal function markers displayed mean blood urea nitrogen at 11.21 mg/dl and mean serum creatinine at 0.82 mg/dl. Proteinuria evaluation showed a urine protein creatinine ratio (mean) of 1.74 and an optimal threshold of 0.30. Sensitivity and specificity for pre-eclampsia diagnosis were 100% and 87.9%, respectively, with positive and negative predictive values of 90.4% and 92%.

Table 2 compares hypertensive retinopathy grades between the current study and Hanumant et al 2017 study, with grade 1 and grade 2 present in 6% and 7%, respectively, in the current study, and 87% exhibiting normal findings.

Table 3 presents a comparison of mean urine protein creatinine ratios across multiple studies, with the current study reporting a value of 1.75±2.32. It is similar to Hossain et al. and Sapna et al. studies, higher than Jung et al study, and lower than Umran et al study. Additionally, Jung et al study indicates a mean 24-hour protein excretion of 2713±2003 mg/day in contrast to the current study.

Table 2: Fundus examination.

Study	Hanumant et al 2017
Hypertensive retinopathy	Present study
Grade 1	6 (6%)
Grade 2	7 (7%)
Normal	87 (87%)

Table 3: Comparison of mean urine protein creatinine ratio in studies.

Study	Mean urine protein creatinine ratio (±SD)
Current study	1.75±2.32
Hossain et al[10]	Similar to current study
Sapna et al[11]	Similar to current study
Jung et al[12]	Higher than current study
Umran et al[13]	Lower than current study
Jung et al[12]	Mean 24-hour protein excretion
This study	2713±2003 mg/day

DISCUSSION

In comparison to Hanumant et al, our study reported a lower prevalence of abnormal fundus examination findings. While these differences may be attributed to variations in patient populations or healthcare practices, they do not diminish the spot ratio's importance as a diagnostic tool. This variation highlights the need for continued research and validation of diagnostic methods to tailor them to specific patient groups and clinical settings, ultimately enhancing patient care and outcomes.[8]

Our study's mean urine protein creatinine ratio aligns with findings from some previous research, reinforcing its reliability as a marker for preeclampsia. However, it is essential to acknowledge that variations in these ratios among different studies may arise from differences in patient demographics, timing of sample collection, or laboratory techniques. These discrepancies emphasize the necessity for standardized protocols when implementing the spot ratio in clinical practice. Standardization ensures consistent and accurate results across diverse settings, making it a valuable tool for widespread adoption and improving diagnostic accuracy.[9]

The spot ratio's potential to provide rapid results and streamline patient care is particularly valuable in resource-constrained settings, such as Kamla Nehru State Hospital for Mother and Child, where efficient healthcare delivery is essential. Our study's high sensitivity, specificity, and favorable ROC curve results affirm its clinical utility and highlight its potential to expedite diagnosis and treatment initiation.[10] However, it is essential to strike a balance between accuracy and practicality, especially in settings where timely intervention can significantly impact patient outcomes. This calls for ongoing research and evaluation to optimize the spot ratio's implementation in various clinical scenarios and healthcare infrastructures.[11]

Moreover, recent advances in the diagnosis and management of preeclampsia, as discussed in Duhig et al., underscore the dynamic nature of research in this field. Integrating these developments into clinical practice and refining diagnostic protocols are essential steps forward in improving patient care and outcomes. [12]

As we consider the broader implications of our findings and the role of the spot urinary protein/creatinine ratio in preeclampsia diagnosis, it becomes evident that a collaborative effort involving healthcare professionals, researchers, and policymakers is essential. Continued research and the development of standardized protocols will further refine the spot ratio's utility, ultimately benefiting pregnant individuals by improving the accuracy and timeliness of preeclampsia diagnosis and management.[13]

By integrating the latest research findings with practical considerations, we can harness the potential of the spot ratio to enhance the care of individuals at risk of preeclampsia, ultimately reducing maternal and fetal morbidity and mortality rates. For a comprehensive understanding of the proteinuria assessment, it's crucial to consider the comparative perspectives provided by Jung et al and Umran et al, which offer valuable insights into the challenges and clinical implications of proteinuria measurement in preeclampsia.

This study has some limitations. Despite the valuable insights provided by this study on the potential efficiency of the spot urinary protein/creatinine ratio as a diagnostic tool for preeclampsia, several limitations should be acknowledged. Firstly, the study's cross-sectional design inherently restricts the establishment of causal relationships, limiting the ability to determine the temporal sequence of events. Additionally, the study focused on a specific healthcare setting, Kamla Nehru State Hospital for Mother and Child, which may impact the generalizability of the findings to broader populations or diverse healthcare environments. The relatively small sample size of 90 inpatients might also affect the statistical power and generalizability of the results. Moreover, variations in patient demographics, local practices, and healthcare infrastructure could introduce confounding factors that influence the outcomes and comparability with other studies. The study's duration, spanning from July 1, 2018, to June 30, 2019, may not capture potential temporal trends or changes in diagnostic practices over an extended period. Finally, while the spot urinary protein/creatinine ratio shows promise, the study does not delve into the cost-effectiveness or feasibility of implementing this diagnostic tool on a broader scale, which warrants further investigation. Despite these limitations, the study contributes valuable insights to the field of preeclampsia diagnosis, emphasizing the need for future research to address these constraints and validate the applicability of the spot ratio in diverse healthcare setting.

CONCLUSION

In conclusion, our study demonstrates that the spot urinary protein/creatinine ratio is a valuable diagnostic tool for preeclampsia, with potential benefits in healthcare institutions such as ours. Further research and standardized protocols are needed to harness its full clinical potential. Implementing this tool can contribute to faster diagnosis and improved patient care, ultimately enhancing maternal and fetal outcomes.

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