Study of Renal Function Test in Pregnant Women with Preeclampsia: A Hospital Based Cross-Sectional Study

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ABSTRACT

Introduction: The multifactorial disease known as preeclampsia presents significant hazards throughout pregnancy and often results in renal impairment. **Aims:** To evaluate renal function tests in pregnant women with preeclampsia compared to normotensive pregnant women. **Methods:** A Hospital based comparative cross-sectional study was carried out for a period of six months from December 2024 to June 2025, involving 80 participants (40 with Pre-eclamptic pregnant women and 40 normotensive pregnant women) aged 18 to 45 years at gestational ages after 30 weeks. Serum urea, creatinine, and uric acid levels were estimated, and statistical analysis was performed using SPSS version 25. **Results:** The median age was 27.5 years and 25 years in the pre-eclamptic and normotensive group respectively. The pre-eclamptic group manifested significant increases in serum urea (21.7 mg/dl vs. 15.8 mg/dl, $p < 0.001$), creatinine (0.70 mg/dl vs. 0.62 mg/dl, $p = 0.039$), and uric acid (7.08 mg/dl vs. 5.5 mg/dl, $p < 0.001$) compared to normotensive group. The pre-eclamptic group systolic and diastolic blood pressure readings were 150.0 mmHg and 100.0 mmHg respectively which vary significantly compared to the normotensive group measurements which were 110.0 mmHg and 70.0 mmHg. **Conclusion:** Our study found that preeclampsia had a negative impact on renal function, as evidenced by elevated levels of serum urea, creatinine and uric acid. These results highlight the importance of monitoring renal function in pregnant women with hypertension since these measurements are crucial indicators of renal impairment in preeclampsia.

***Keywords*:** Creatinine, Preeclampsia, Urea & Uric acid

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INTRODUCTION

Preeclampsia (PE) and eclampsia is a multifactorial syndrome which is a severe complication during pregnancy.[1] Globally, World Health Organization (WHO), reported the incidence of PE ranges between 2% to 10% of pregnancies[2] and is the second leading cause of direct maternal and fetal deaths.[3] PE complicates nearly 3% of pregnancies[4] and the incidence of PE is reported to be 2.3% and 8-10% in United states and India respectively.[5,6] Whereas in Nepal, according to the result of a Meta-Analysis the prevalence of PE and eclampsia were 2.6% and 0.5%.[7] PE is a multisystem disorder causing damage to many maternal organs mainly the kidney and liver.[8] PE causes broad endothelial dysfunction, which has a special impact on the renal system.[9] In normal pregnancies, physiologic vasodilation increases renal plasma flow and glomerular filtration rate (GFR) by 50%, lowering blood creatinine and urea levels. At the same time, in PE these adaptations are

compromised and glomerular endotheliosis, a hallmark lesion, results in decreased renal perfusion, decreased GFR, and proteinuria.[9] According to some studies, serum urea, creatinine and uric acid were significantly increased in pre-eclamptic women.[8,10] However, in another study, serum urea and serum creatinine were increased but were insignificant in PE.[6] Since the alteration of renal function in PE is yet unclear and there is a lack of similar studies from the western region of Nepal. So, the current study was conducted with an aim to evaluate alterations of renal function tests in pregnant women with preeclampsia and compare them with those of normotensive pregnant women in a tertiary care center at Kohalpur.

METHODS

A hospital-based comparative cross-sectional study was conducted at the Department of Biochemistry in collaboration with the Department of Obstetrics and Gynaecology of Nepalgunj Medical College Teaching Hospital (NGMCTH), Kohalpur, for a period of six months from December 2024 to June 2025. Ethical approval for the study was obtained from the Institutional Review Committee of NGMCTH (Ref: 35/081-082 dated December 2024). Prior to enrollment oral and written consent were obtained from all the participants. The participants were pregnant women, being primigravida/ multigravida, with an age range of 18 to 45 years and gestational age greater than 30 weeks, admitted to the labor room, Department of Obstetrics and Gynaecology, NGMCTH were included in our study. Participants with proteinuria caused by conditions other than PE, participants with pre-existing hypertension, and participants who refused consent were excluded from the study. Using the following formula, a convenient sampling technique was employed to determine the sample size.[7]

Prevalence of PE (P): 2.6%[7]

q = 100 - p

Margin of error (d)= 5

Z= 1.96 at confidence interval 95%

Sample size (n) = Z^2pq/d^2

= $(1.96)^2$ (2.6) (97.4) / $(5)^2$

= 3.8 x 2.6 x 97.4 / 25

=39

The study participants were divided into two groups: pre-eclamptic group and normotensive group. A total of 80 participants were enrolled in the study. Out of which 40 pregnant women clinically diagnosed with preeclampsia were enrolled into the pre-eclamptic group and an equal number of age and gestational age-matched normotensive pregnant women were enrolled into the normotensive group. PE is diagnosed as gestational hypertension (systolic blood pressure > 140 mmHg and/or diastolic blood pressure > 90 mmHg) measured on two occasions separated by at least 6 hours and proteinuria (≥ 300 mg/ 24-hour urine or urine protein/ creatinine ratio (PCR) ≥ 0.3 mg/mg or qualitative >1+) or other maternal organ dysfunction after 20 weeks of gestation.[11] Three ml of venous blood was collected in a gel tube under sterile conditions and was subjected to centrifugation for 5 minutes at 3500 revolutions per minute (RPM) to separate serum, which was processed for serum urea, creatinine and uric acid by Mindray BS 430 with wet chemistry principle. Serum urea, creatinine and uric acid were measured by urease-glutamate Dehydrogenase, UV method, Sarcosine-oxidase method and Uricase-peroxidase method, respectively. At the same time, urine protein was detected by using the urine dipstick method.

Statistical analysis: Data were inputted into a Microsoft Excel spreadsheet and analysed using the Statistical Package for the Social Sciences (SPSS) version 25. The normality of the data was judged using the Shapiro-Wilk test. Since the data of both pre-eclamptic and normotensive group were not normally distributed. So, the analysis was done using the non-parametric tests. Results were expressed as a median with an interquartile range. The mean ranks between the pre-eclamptic and normotensive groups was compared using the Maan- Whitney U test. A p-value <0.05 was considered statistically significant.

RESULTS

In the current study, the majority of participants were ≤25 years in both the pre-eclamptic and normotensive groups.

Parameters	Median (Interquartile range)		
	Total Participants	Pre-eclamptic group	Normotensive group
Age (years)	27.0 (22.2 – 32.0)	27.5 (23.25 – 32.0)	25.0 (22.0 – 31.75)
Urea (mg/dl)	17.7 (15.0 – 25.0)	21.7 (16.29 – 28.10)	15.8 (14.6 – 18.3)
Creatinine (mg/dl)	0.64 (0.57 – 0.76)	0.70 (0.58 – 0.97)	0.62 (0.51 – 0.70)
Uric acid (mg/dl)	6.15 (5.40) – 7.37	7.08 (6.05 – 7.96)	5.5 (4.62 – 6.42)
POG (weeks)	37.0 (34.25 – 39.0)	36.5 (33.0 – 39.0)	37.0 (35.25 – 39.0)
SBP (mm Hg)	130.0 (110.0 – 150.0)	150.0 (140.0 – 160.0)	110.0 (100 – 120.0)
DBP (mm Hg)	90.0 (70.0 – 100.0)	100.0 (100.0 – 107.5)	70.0 (60.0 -80.0)

POG: Period of gestation, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

Table I: Baseline characteristics of the Pre-eclamptic and Normotensive group

Table I shows that serum urea, creatinine, uric acid, SBP and DBP increase in the pre-eclamptic group compared to the normotensive group.

	Age group (years)	n (%)
Pre-eclamptic group	≤25	17 (42.5)
	26 - 30	9 (22.5)
	31 - 35	11 (27.5)
	36 - 40	3 (7.5)
Normotensive group	≤25	21 (52.5)
	26 - 30	7 (17.5)
	31 - 35	8 (20.0)
	36 - 40	4 (10.0)

n: Number of participants, %: percentage of participants

Table II: Age distribution of Pre-eclamptic and Normotensive groups

Table II shows that the majority of participants in the Pre-eclamptic and Normotensive groups were ≤25 years, accounting for roughly 42.5% and 52.5%, respectively.

Parameters	Median (Interquartile range)		
	Pre-eclamptic group	Normotensive group	P value[a]
Age (years)	27.5 (23.25 – 32.0)	25.0 (22.0 – 31.75)	0.542
Urea (mg/dl)	21.7 (16.29 – 28.10)	15.8 (14.6 – 18.3)	0.001
Creatinine (mg/dl)	0.70 (0.58 – 0.97)	0.62 (0.51 – 0.70)	0.039
Uric acid (mg/dl)	7.08 (6.05 – 7.96)	5.5 (4.62 – 6.42)	0.001
POG (weeks)	36.5 (33.0 – 39.0)	37.0 (35.25 – 39.0)	0.317
SBP (mm Hg)	150.0 (140.0 – 160.0)	110.0 (100 – 120.0)	0.001
DBP (mm Hg)	100.0 (100.0 – 107.5)	70.0 (60.0 -80.0)	0.001

POG: Period of gestation, SBP: Systolic blood pressure, DBP: Diastolic blood pressure a:Mann-Whitney U test, P < 0.05 was considered statistically significant and was indicated in bold type

Table III: Comparison of parameters between the pre-eclamptic group and normotensive group

Table III shows that serum urea, creatinine, uric acid, SBP and DBP were significantly increased in the pre-eclamptic group compared to the normotensive group.

DISCUSSION

Preeclampsia-related renal impairment has been linked to several factors, most likely glomerular endotheliosis, hemodynamic alterations, and podocyte destruction.[12] Although the renal impairment is typically not noticeable throughout the prenatal period, pre-eclamptic patients are more likely to experience it, and if renal impairment is not identified promptly, it may develop into renal failure and eventually cause other vascular diseases.[12] So, the current study was conducted to study the renal function test in pregnant women with preeclampsia visiting tertiary care hospital in Western Nepal.

The present study enrolled 80 participants, including 40 pregnant women diagnosed with preeclampsia into the preeclamptic group and an equal number of normotensive healthy pregnant women into the normotensive group. The median age of participants was 27.5 and 25 years in the pre-eclamptic and normotensive groups respectively and the majority of participants belonged to the age group ≤25 years in both the pre-eclamptic (n=17) and normotensive groups (n=21).

The present study represents that serum urea was increased in the pre-eclamptic group [21.7 (16.29 - 28.10)] compared to the normotensive group [15.8 (14.6 – 18.3)] and was statistically significant (p = 0.001). The findings of our study were in line with the study done by Abdelrahman R et al[10] and Hamed S et al.[13] In contrast to our findings, a study done by Manjareeka M et al[14] reported that serum urea was slightly increased in preeclamptic women (28.07 ± 4.97) compared to normotensive pregnant women (26.46 ± 3.55) but was statistically insignificant (p = 0.068). Our current study also showed that serum creatinine was increased in the pre-eclamptic group [0.70 (0.58 - 0.97)] compared to the normotensive group [0.62 (0.51- 0.70)] and was statistically significant (p = 0.03). The findings in our study were in accordance with the study done by Ambad DRS et al[6] while the study done by Hamed S et al[13] reported that serum creatinine was increased in pre-ecalmptic women (0.84 ± 0.34) in comparision to normotensive pregnant women (0.79 ± 0.31) but was insignificant (p = 0.508). Placental tissue from preeclamptic women has decreased monoamine oxidase activity and increased serotonin levels than placental tissue from normal pregnant women. These factors decrease renal perfusion, lowering GFR in preeclamptic women compared to normal pregnant women, which in turn leads to increased urea and creatinine levels in blood.[13] In addition, the micro-angiopathic hemolysis generated by maternal endothelial dysfunction also contributes to the increase in blood urea levels by increasing the synthesis of urea.[13]

In our study, serum uric acid was higher in pre-eclamptic women [7.08 (6.05 – 7.96)] than in normotensive pregnant women [5.5 (4.62 – 6.42)] and the difference was statistically significant (p = 0.001). The findings of our study were in agreement with the study done by Jumaah M et al[8], Niraula

A et al[12] and Dhungana A et al.[15] A study by Adebisi OO et al[9] reported that serum uric acid was increased in the pre-eclamptic group (1.60 ± 0.49) compared to the control group (1.29 ± 0.20) but the difference was not significant (p = 0.135). During normal pregnancy, uric acid concentration decreases in blood by 25% and is due to increased renal plasma flow and GFR causing an increased in uric acid clearance from 6 to 12 mL/min to 12 to 20 mL/min while in PE these adjustment are compromised causing hyperuricemia in PE.[9,15] In PE, hyperuricemia is multifaceted and is caused by increased reabsorption of uric acid and decreased renal excretion, as well as increased oxidative stress from placental ischemia and increased xanthine oxidase activity since uric acid is a byproduct of purine catabolism.[6] The small sample size of our hospital-based study is a limitation. Clarifying the renal function alteration can be made easier with a larger sample size and a general population investigation. It would be more helpful if urinary measurements of uric acid, creatinine, and various oxidative stress-inducing substances were performed.

CONCLUSION

Our current study concludes that renal function is negatively affected by preeclampsia, highlighting the necessity to evaluate renal function tests, particularly serum uric acid, for all pregnant women with high blood pressure, as it is the first indicator of how renal function is influenced in preeclamptic women.

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