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Original Research Article

Estimation of serum uric acid levels as adverse prognostic indicator of perinatal outcome in pregnant women with pre-eclampsia: a prospective observational study

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ABSTRACT

Background: Preeclampsia, a spectrum of hypertensive disorders of pregnancy, continues to have a significant impact in developing nations like India. Predicting the development of severe pregnancy-induced hypertension would be beneficial because all treatment protocols include some degree of expectant management. Hence, in this prospective observational study we aimed to estimate serum uric acid level and evaluated serum uric acid level as an indicator of adverse perinatal outcome in pregnant women with preeclampsia.

Methods: This is a prospective observational study conducted with total of 200 pregnant women at Department of Obstetrics and Gynaecology, S.S. Institute of Medical Science and Research Centre (SSIMRC) Davangere, Karnataka. The study subjects were divided in to two groups viz. Cases (n=100) and Control (n=100) groups. In Case group pregnant women diagnosed with preeclampsia were included and control group consist of normotensive pregnant women. All selected women were subjected to clinical examination and blood pressure was recorded. Blood samples were collected and serum was separated for serum uric acid estimation.

Results: The mean ($\pm$ SD) age of the study subjects was found to be 25.56 ($\pm$ 3.56) and 24.75 ($\pm$ 2.48) in cases and control group respectively ($p=0.214$). There was a significant difference ($p<0.05$) in gestational age of delivery between cases (34.98 ± 1.58) and control group (38.54 ± 2.01). The mean ($\pm$ SD) serum uric acid level between cases and control was found to be 7.36 ($\pm$ 0.21) and 3.30 ($\pm$ 0.13) which is statistically significant ($p<0.001$). There was a significant ($p<0.001$) positive correlation exists between SBP and serum uric acid ($\rho=0.718$) and DBP and serum uric acid ($\rho=0.534$).

Conclusions: This study clearly established association between serum uric acid levels and adverse perinatal outcome in pregnant women with preeclampsia. Hence, serum uric acid level >7 mg/dl in pregnant women with mean gestational age of 35 weeks either in primigravida or multigravida could be used as a prognostic marker of adverse perinatal outcome in pregnant women with preeclampsia.

Keywords: Blood pressure, Preeclampsia, Pregnant women, Prognostic marker, Uric acid

INTRODUCTION

Preeclampsia is a clinical syndrome characterized by hypertension (blood pressure $\geq 140/90$ mmHg) and proteinuria (24 hr urinary protein ≥ 0.3 g). Preeclampsia occurs in 2-8% of pregnancies and a leading cause of maternal and perinatal mortality and morbidity.¹ The

incidence is still higher in India of around 8-10%.² As per the world health report the maternal mortality during pregnancy and puerperium is around 12%. In developing countries, 17% of direct obstetric deaths are as a result of hypertension.³ The disorder is probably multifactorial, although most cases of preeclampsia are characterized by maternal uterine vascular remodeling by placental

trophoblast cells. The most common models of the different reports available on animal models that have been used to study different aspects of preeclampsia are placental oxygen dysregulation, abnormal trophoblast invasion, inappropriate maternal vascular damage and maternal and foetal immune interactions.⁴ Strangely, the exact etiopathogeneses for hypertensive disorders of pregnancy including preeclampsia and eclampsia, still remains obscured and presents an interesting unsolved mystery in obstetric practice.⁵

Preeclampsia is associated with several complications.⁶ The number of babies who die from these disorders is thought to be on the order of 500,000 per annum.⁷ Its incidence has continued to increase worldwide accounting for about 60,000 deaths worldwide annually.^{8,9} In developing countries where access to health care is limited, preeclampsia is a leading cause of maternal mortality, causing an estimated >50,000 maternal deaths per year.¹⁰ While maternal death due to preeclampsia is less common in developed countries, maternal morbidity is high and is a major contributor to intensive care unit admissions during pregnancy.¹¹ Approximately 12 to 25% of fetal growth restriction and small for gestation age infants as well as 15 to 20% of all preterm births are attributable to preeclampsia; the associated complications of prematurity are substantial including neonatal deaths and serious long-term neonatal morbidity.¹² Thus, clinical prediction of disease complications may facilitate initiation of timely management to avert mortality and morbidity in the mother and baby.¹³⁻¹⁵

Uric acid is the end product of purine metabolism in humans and is generated by the action of the enzyme, xanthine oxidase, which catalyzes the last two steps of uric acid conversion: hypoxanthine to xanthine and from xanthine to uric acid.¹⁶ There is ample evidence that uric acid has multiple actions impacting on cellular metabolism. Uric acid is a marker of oxidative stress, tissue injury, and renal dysfunction and therefore might be helpful in the prediction of complications of preeclampsia.^{17,18}

Hyperuricemia is found to be one of the earliest laboratory manifestations of preeclampsia.¹⁹ Elevated uric acid concentrations were first noted in preeclamptic women in the late 1800s. Since that time numerous reports have demonstrated a relationship between uric acid concentrations and severity of disease.^{20,21} At the same time, it is one of the most consistent and earliest detectable changes in preeclampsia and has been cited as a better predictor of fetal risk than blood pressure. Furthermore, hyperuricemia was evident in 16% of women with gestational hypertension without proteinuria and 75% of women with clinically diagnosed preeclampsia. Hyperuricemia among pregnant hypertensive women was associated with an excess of adverse fetal outcomes.²¹

Since 1800s, there have been a lot of conflicting reports in the literature with regards to the association between

maternal hyperuricaemia and severity of preeclampsia and pregnancy outcome.²² Hence, in the present prospective observational study we aimed to assess estimation of serum uric acid level and evaluation of serum uric acid level as an indicator of preeclampsia and perinatal outcome in pregnant women.

METHODS

Study design and patients

This is a prospective observational study conducted with total of 200 pregnant women at Department of Obstetrics and Gynaecology, S.S. Institute of Medical Science and Research Centre (SSIMRC) Davangere, Karnataka. The study subjects were divided in to two groups viz. Cases (n=100) and Control (n=100) groups. In Case group pregnant women diagnosed with preeclampsia were included and control group consist of normotensive pregnant women. The ethical committee approval was obtained before the conduct of study.

Inclusion criteria

Singleton pregnancy, gestational age ≥ 28 weeks, patient diagnosed as preeclampsia based on BP $\geq 140/90$ and urine protein $\geq 1+$ were included.

Exclusion criteria

Known hypertensive patients before, known diabetic patients, known renal disease patients, known gout patients, patients who received chemotherapy within 4 weeks of study enrollment, patients on thiazide diuretics medication, and patients with immuno-compromised states were excluded.

Data collection and assessment parameters

After obtaining informed consent, a detailed history such as age, parity, body weight and height, last menstrual period, medical history, drug history, previous obstetric history, and previous history of preeclampsia, and demographic data were collected from qualifying patients using a pre-designed structured proforma. All selected women were subjected to clinical examination and blood pressure was recorded. Blood samples were collected under aseptic precautions in plain vial and serum was separated for serum uric acid estimation. Serum samples were analyzed by semiautomated biochemistry analyzer. Uric acid estimation was carried out using uricase peroxidase method.

Statistical analysis

Data were entered in Microsoft Excel 2021 and statistical analysis was done using IBM Statistical Software for Social Sciences (SPSS) version 22. Categorical variables were represented in the form of percentages and frequencies. Continuous variables were presented as

descriptive statistics (Mean and Standard deviation). The association between categorical variables were assessed with Chi-square test. Comparison of continuous variables between the case and control groups was done using independent sample t-test. $p \leq 0.05$ was considered statistically significant.

RESULTS

The mean ($\pm$ SD) age of the study subjects was found to be 25.56 ($\pm$ 3.56) and 24.75 ($\pm$ 2.48) in cases and control group respectively without any statistically significant differences ($p=0.214$). The majority of study subjects were found between age group of 21-30 years in both cases (68%) and control (72%) group. There was a significant difference ($p<0.05$) in gestational age was observed between cases (34.98 $\pm$ 1.58) and control group (38.54 $\pm$ 2.01). The distribution of study subjects based on education status ($p=0.115$), occupation ($p=0.192$), and parity ($p=0.09$) were not statistically significant between cases and control groups (Table 1).

Table 1: Distribution of study subjects based on socio-demographic and baseline characteristics.

Variables	Cases (n=100)	Control (n=100)	P value
Age (years), N (%)			
≤20	8 (8)	10 (10)	
21-30	68 (68)	72 (72)	
>30	24 (24)	18 (18)	
Mean±SD	25.56±3.56	24.75±2.48	0.214
Education status, N (%)			
Undergraduate	16 (16)	23 (23)	0.115
Graduate	58 (58)	42 (42)	
Post-graduate	26 (26)	35 (35)	
Occupation, N (%)			
Housewife	64 (64)	59 (59)	0.192
Government employee	11 (11)	9 (9)	
Private employee	25 (25)	32 (32)	
Parity, N (%)			
Primigravida	55 (55%)	41 (41)	0.09
Multigravida	45 (45)	59 (59)	
Gestational age	34.98±1.58	38.54±2.01	<0.05

Values are expressed as mean $\pm$ standard deviation (SD) unless otherwise stated

The mean ($\pm$ SD) serum uric acid level between cases and control was found to be 7.36 ($\pm$ 0.21) and 3.30 ($\pm$ 0.13). The mean difference of serum uric level was found to be statistically significant ($p<0.001$) between control and cases groups (Figure 1).

The mean ($\pm$ SD) systolic blood pressured (SBP) recorded between cases and control was found to be 163 ($\pm$ 2.16) and 113 ($\pm$ 2.49). The mean ($\pm$ SD) diastolic blood pressured (DBP) recorded between cases and control was found to

be 112 ($\pm$ 1.63) and 76 ($\pm$ 1.25). Both SBP and DBP were recorded significantly ($p<0.001$) higher in case groups when compared with control group (Table 2).

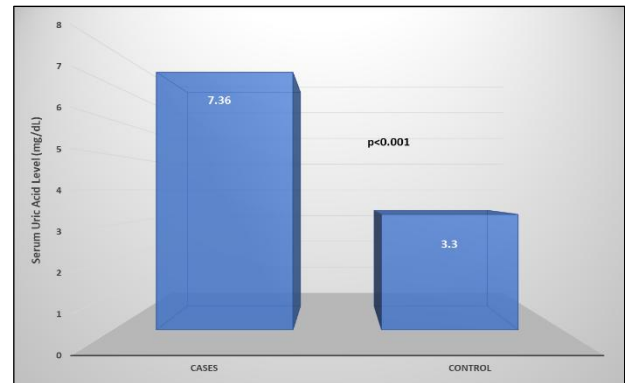


Figure 1: Serum uric acid level (mg/dl) between control and cases.

Table 2: Distribution of study subjects based on blood pressure.

Variables	Cases (n=100)	Control (n=100)	P value
SBP	163 $\pm$ 2.16	113 $\pm$ 2.49	<0.0001
DBP	112 $\pm$ 1.63	76 $\pm$ 1.25	<0.0001

Values are expressed as mean $\pm$ standard deviation (SD)

Table 3: Correlation between serum uric acid and blood pressure.

Variables	Values	P value	Pearson correlation (ρ)
Systolic blood pressure (SBP)			
Cases (n=100)	163±2.16	<0.0001	0.718
Control (n=100)	113±2.49		-0.157
Diastolic blood pressure (SBP)			
Cases (n=100)	112±1.63	<0.0001	0.534
Control (n=100)	76±1.25		-0.143

Values are expressed as mean $\pm$ standard deviation (SD)

Table 4: Association between serum uric acid and perinatal outcomes in cases group.

Variables	Serum UA <7 mg/dl	Serum UA >7 mg/dl	P value
Perinatal mortality, %	20	80	<0.001
Preterm birth, %	46	54	0.045
LBW, %	32	68	<0.001
NICU admission, %	40	60	<0.010
RDS, %	38	62	<0.001
IUGR, %	46	54	<0.001

UA=Uric acid; NICU=Neonatal intensive care unit; RDS=Respiratory distress syndrome; IUGR=Intrauterine growth restriction; LBW=Low birth weight

The results of correlation between serum uric acid and SBP and DBP were represented in Table 3. Results revealed that in cases group, there was a significant ($p<0.001$) positive correlation exists between SBP and serum uric acid ($\rho=0.718$) and DBP and serum uric acid ($\rho=0.534$). Whereas in control group, there was a significant ($p<0.0001$) negative correlation exists between SBP and serum uric acid ($\rho=-0.157$) and DBP and serum uric acid ($\rho=-0.143$).

Among the study subjects in cases groups perinatal outcomes viz. perinatal mortality ($p<0.001$), preterm birth (0.045), LBW ($p<0.001$), NICU admission ($p<0.010$), RDS ($p<0.001$), and IUGR ($p<0.001$) were distributed significantly higher in patients' whose serum uric acid was estimated >7 mg/dl (Table 4).

DISCUSSION

Hypertensive disorders of pregnancy which frequently manifest as preeclampsia continues to exert an enormous toll in developing countries like India and also in western society. Despite progress in its prevention, detection and treatment, it continues to be the leading cause of maternal death.³ The ultimate goal of any protocol for management of preeclampsia must be maternal safety, delivery of a healthy live mature newborn. As some amount of expectant management exists in all treatment protocols it would be advantageous to predict development of severe pregnancy induced hypertension.¹⁹ Therefore, current prospective observational study was designed with the main objectives of estimation of serum uric acid level and evaluation of serum uric acid level as an indicator of preeclampsia and perinatal outcome in pregnant women.

In our study the mean age of the study subjects was found to be 25.56 and 24.75 in cases and control group. In concurrence with our study findings Umasatya et al, reported similar mean age of study subjects such as 24.50 and 23.46 years among cases and controls respectively.²³ The mean gestation recorded among study subjects of cases and control group in our study was found to be 34.98 weeks and 38.54 weeks respectively. These findings were comparable with the findings reported by various other research investigators in the literature.²³ In concurrence with literature findings distribution of study based on parity (primigravida and multigravida) between cases and control groups was not significant in our study.²⁴

In our study elevated serum uric acid level was observed among subjects of case groups (7.36 mg/dl) compared with control group (3.30 mg/dl) with statistically significant difference ($p<0.001$). These results were comparable with findings reported by Gandhi et al, wherein authors reported serum uric acid levels of 5.94 mg/dl and 4.63 mg/dL in cases and control groups respectively.²⁵

In our study SBP and DBP were recorded significantly higher among study subjects of case group when compared with control group. Furthermore, there was a significant

positive correlation exists between SBP and DBP and serum uric acid. These findings were in accordance with literature studies reported by various research investigators. Sonagra et al, reported, mean SBP of 157 mmHg and 113 mmHg respectively among cases and controls.²⁶ Gandhi et al, reported mean DBP of 96.24 mmHg and 70.13 mmHg among cases and controls respectively.²⁵

Furthermore, in our study perinatal outcomes viz. perinatal mortality, preterm, LBW, NICU admission, RDS, IUGR were distributed significantly higher in patients' whose serum uric acid was estimated >7 mg/dl. These observations were consistent with the literature studies. According to Robert et al, the risk of preterm is increased in group of patients with hypertension proteinuria, hyperuricemia and even in the absence of proteinuria, hyperuricemia is a significant risk factor for preterm birth.²¹ In other study by Magann et al reported a positive correlation between increasing/raised serum uric acid level and increased incidence of perinatal mortality, stillbirth.²⁷ The findings depicted that the levels of uric acid can be used as a marker for prediction of maternal complication and for prevention of these complications by early intervention.³

There has been certain limitation of this prospective observational study. First, minimum sample size of 100 patients in case group, which is not large enough to make generalization of results. Second, non-availability of baseline serum uric acid readings for patients of cases groups since serum uric acid was estimated after the diagnosis of preeclampsia.

CONCLUSION

In conclusion, the results of the current study clearly established association between serum uric acid levels and adverse perinatal outcome in pregnant women with preeclampsia in the form of increased incidence of perinatal mortality, low birth weight, NICU admission, RDS, IUGR. Therefore, serum uric acid level >7 mg/dl in pregnant women with mean gestational age of 35 weeks either in primigravida or multigravida could be used as a prognostic marker of preeclampsia.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Gupta AK, Talati S, Bhattacharya S, Singh A. Health system strengthening-focusing on referrals: An analysis from India. *JOJ Nurs Health Care.* 2017;2(4):01-03.
- Majella MG, Sarveswaran G, Krishnamoorthy Y, Sivaranjini K, Arikrishnan K, Kumar SG. A longitudinal study on high-risk pregnancy and its

- outcome among antenatal women attending rural primary health centre in Puducherry, South India. *J Educ Health Promot.* 2019;8:200.
3. Goswami P, Bindal J, Chug N. To study pattern of obstetric cases referred at tertiary care centre in Central India. *Int J Reprod Contracept Obstet Gynecol.* 2017;6(6):2370-4.
 4. Stefanini A. District hospitals and strengthening referral system in developing countries. *World Hosp Health Serv.* 1994;30(2):14-9.
 5. Sumera S, Nuzhat R, Sadia A. Feto-maternal outcome in cases referred to tertiary care hospital after trial of labour. *J Sheikh Zayed Med Coll.* 2013;4(2):444-7.
 6. Gupta PR, Chaudhary SN, Gonnade NV. Maternal and fetal outcome in referred patients to tertiary care centre. *Sch J App Med Sci.* 2016;4(5C):1624-63.
 7. Anavadia J, Patel E, Verma R, et al. A study of obstetric referral patients in a tertiary health care center in South Gujarat. *Indian J Obstet Gynecol.* 2020;8(1):15-20.
 8. Patel HC, Singh BB, Moitra M, Kantharia SL. Obstetric referrals: scenario at a primary health centre in Gujarat. *Natl J Community Med.* 2012;3(4):711-4.
 9. Sabale U, Patankar AM. A study of maternal and perinatal outcome in referred obstetrics cases. *J Evol Med Dent Sci.* 2015;4(26):4448-55.
 10. Patel P, Tiwari P. Evaluation of obstetrics referral causes and their outcome at a tertiary care centre of northern Madhya Pradesh: A descriptive study. *Indian J Sci Res.* 2023;12(11):8-12.
 11. Vandhana PM, Zahir F, Das DN, Deori RK. Fetomaternal outcome of referred obstetric patients in a tertiary centre in North East India: A cross-sectional study. *J Clin Diagn Res.* 2023;17(10):QC06-9.
 12. Mahendra G, Kavya BS, Pukale RS. Study of maternal and perinatal outcome in referred obstetric cases. *Obs Gyne Rev J Obstet Gynecol.* 2019;5(2):106-11.
 13. Poornima M, Daver RG. Maternal and fetal outcome in obstetric referred cases. *Glob J Res Anal.* 2018;7(2):544-7.
 14. Monika, Verma K, Panwar B, Hooja N, Kaswan PP, Yadav S. Maternal and neonatal outcome among referred women. *Int J Reprod Contracept Obstet Gynecol.* 2025;14(1):143-5.
 15. Goswami D, Makhija A. A study of high-risk obstetric referrals to tertiary care hospital in Garhwal, Uttarakhand. *Int J Sci Res.* 2015;4(10):1091-3.
 16. Ghardallou M, Limam M, Khelifi A, Khairi O, Khairi H, Mtiraoui A, et al. Obstetric referrals to a tertiary care maternity: a descriptive study. *Pan Afr Med J.* 2019;33:306.

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