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Original Research Article

Hyperuricemia and maternal outcome in pregnancy induced hypertension: prospective study in a tertiary care center in Mumbai, India

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ABSTRACT

Background: Pregnancy induced hypertension, preeclampsia, eclampsia are serious complications of pregnancy. They are the leading causes of morbidity and mortality in the world and one of the leading causes for perinatal mortality also. It is the systemic disease affecting all vital organs including the fetus. Estimation of biochemical markers can give us the indication of the severity and prediction of the outcome. Serum uric acid is the end product of purine metabolism, amongst others like creatinine, LDH, transaminases.

Methods: It was a type of prospective descriptive study. The present study was conducted in department of obstetrics and gynecology, Tertiary care hospital, Mumbai, Maharashtra, India.

Results: Pregnancy induced hypertension was most common in age group of 20-25 years, most common complication was preterm delivery which accounts for 43% of maternal complications. 60% of the cases with IUFD had serum uric acid level 8-8.9 mg/dl, 3% of the patients had HELLP syndrome.

Conclusions: We found severity of complication associated with raise in serum uric acid levels.

Keywords: PIH, IUFD, HELLP, LSCS

INTRODUCTION

Pregnancy is a physiological state associated with varied biochemical and maternal adaptation in response to physical stimuli provided by fetus and placenta.¹

Hypertensive disorders represent the most common complication of pregnancy affecting between 7 to 15 % of all gestation and account for approximately a quarter of all antenatal admissions.²

Hypertensive disorders are responsible for not only maternal deaths but also substantial morbidity for the

pregnant women, 5% of women with severe preeclampsia or eclampsia were admitted to intensive care.³

Hyperuricemia is associated with many complications such as hypertension, metabolic syndrome, chronic kidney disease and diabetes in non-adults. They are high risk factors for the development of preeclampsia.

Uric acid is an end product of metabolism of purine compounds and its daily synthesis is about 400 mg and from dietary sources about 300 mg. Normal uric acid pool in males is about 1200 mg and in females is about 600 mg.

75% of serum uric acid is excreted in urine and its remainder is degraded to allantoin in the gastrointestinal

tract by the bacterial enzymes. 98-100% of uric acid is reabsorbed in proximal convoluted tubule and it is secreted into the distal proximal convoluted tubule and further it is absorbed in to the distal convoluted tubule. Net excretion of uric acid is 6-12% and normal serum urate level in males ranges from 2.5-8 mg/dl and in females ranges from 1.9-7.5 mg/dl.

In pregnancy uric acid excretion is disproportionately larger than increase in filtered load, so net reabsorption of uric acid is reduced in normal pregnancy hence fall in serum uric level. The excretion of serum uric acid remains constant as the pregnancy advances even though there is gradual increase in filtered load. Uric acid contributes to pathogenesis of preeclampsia by following mechanisms Uric acid activates the inflammation in the trophoblast and IL-1 beta production which induces inflammation at the maternal fetal interface leading to placental dysfunction and preeclampsia.

Aims and objectives of the study

Aim was to study raised serum uric acid as a biochemical marker for maternal outcomes in pregnancy induced hypertension.

Objectives were to estimate the serum uric acid levels in gestation more than 20 weeks with pregnancy induced hypertension, to evaluate the relationship between serum uric acid and maternal outcome, and to correlate serum uric acid levels with maternal morbidity and mortality.

METHODS

The present study is a prospective study conducted at department of obstetrics and gynecology, Grant medical college Mumbai from September 2020 to September 2022.

Subject population

Total 100 pregnant women with pregnancy more than 20 weeks of gestation with systolic BP of ≥ 140 mmHg and/or diastolic blood pressure of ≥ 90 mmHg or both and urine albumin positive by dipstick method and serum uric acid level ≥ 6 mg/dl admitted at department OBG at tertiary care hospital /centre Mumbai.

Inclusion criteria

Pregnant women who were willing to give consent, pregnant women with gestational age more than 20 weeks, systolic blood pressure of ≥ 140 mmHg or/and diastolic blood pressure of ≥ 90 mmHg, albumin positive with dipstick method, serum uric acid level more than or equal to 6 mg/dl.

Exclusion criteria

Pregnant women were excluded from the study if they were not willing to give consent, hypertension before 20

weeks of gestation, family history of hypertension or diabetes mellitus, pre-existing medical illness like heart disease, diabetes mellitus, renal diseases or thyroid disorders, patients with gout.

Study procedure

Prospective study was done in pregnant women with gestational age more than 20 weeks with systolic blood pressure of ≥ 140 mmHg or diastolic blood pressure of ≥ 90 mmHg or both and urine albumin positive by dipstick method, admitted at OBG at tertiary care hospital/centre Mumbai, and uric acid detection was done by automated analyser method and clinical outcome was studied after 20 weeks of gestation.

Statistical analysis

Statistical analysis was done by SPSS software and the difference with a p value of <0.05 was considered statistically significant.

RESULTS

Pregnancy induced hypertension was most common in age group of 20-25 years i.e. 43% followed by age group 26-30 years i.e. 25% (Table 1).

Table 1: Distribution of cases according to age group.

Age group	Frequency	Percent
<20	8	8
20-25	43	43
26-30	25	25
31-35	18	18
36-40	5	5
>40	1	1
Total	100	100

Table 2: Distribution of cases according to gravida and parity.

Gravida and parity	Frequency	Percent
Primi	48	48
G2	27	27
G3	16	16
$\geq G4$	9	9
Total	100	100

Pregnancy induced hypertension was most common in primi patients (48%) followed by G2 patients (27%) (Table 2).

In our study, 39% of the patients had proteinuria of 3+, and 26% had proteinuria of 2+, and 22% had proteinuria of 1+ (Table 3).

In our study, 42% of PIH were having serum uric acid level ranging from 6-6.9 mg/dl ,48% of PIH patients were

having serum uric acid between 7-9 mg/dl. 10% of patient had serum uric acid more than 9 mg/dl (Table 4).

Table 3: Distribution of proteinuria with serum uric acid level.

Proteinuria	Frequency	Percentage
Trace	5	5
1+	22	22
2+	26	26
3+	39	39
4+	8	8

Table 4: Distribution of cases according to uric acid level.

Uric acid level	Frequency	Percent
6-6.9	42	42
7-7.9	24	24
8-8.9	24	24
≥9	10	10
Total	100	100

Out of 100 PIH patients with serum uric acid level more than 6 mg/dl, there were, 38 cases of non-severe preeclampsia (38%), 47 cases of severe preeclampsia (47%) and 15 case of eclampsia (15%) in our study (Table 5).

In our study, most common complication was preterm delivery which accounts for 43% of maternal complications. 34.90% of patients had serum uric acid level between 7-7.9 mg/dl and 34.90% had serum uric acid level 8-8.98 mg/dl (Table 6). Preterm delivery has associated with increased serum uric acid level, p value <0.001, statistically significant.

Table 5: Distribution of cases according to type of PIH.

HTN disorders	Frequency	Percent
Mild preeclampsia	38	38
Severe preeclampsia	47	47
Eclampsia	15	15
Total	100	100

Table 6: Correlation between uric acid level and maternal complications.

Maternal complications	Uric acid level				Total	P value
	6-6.9	7-7.9	8-8.9	>9		
IUGR	N	3	9	9	6	0.552
	%	11.10%	33.30%	33.30%	22.20%	
Abruption	N	1	0	3	2	0.172
	%	16.70%	0.00%	50.00%	33.30%	
PTD	N	7	6	15	15	<0.001*
	%	16.30%	14.00%	34.90%	34.90%	
Ascites	N	3	1	4	3	0.052
	%	27.30%	9.10%	36.40%	27.30%	
Pleural effusion	N	2	1	2	4	0.141
	%	22.20%	11.10%	22.20%	44.40%	
IUFD	N	1	0	6	3	0.013*
	%	10.00%	0.00%	60.00%	30.00%	
Renal injury	N	0	0	0	2	0.108
	%	0.00%	0.00%	0.00%	66.70%	
PPH	N	0	1	0	0	0.707
	%	0.00%	100.00%	0.00%	0.00%	
HELLP syndrome	N	3	0	0	0	<0.001*
	%	100.00%	0.00%	0.00%	0.00%	
Pancreatitis	N	1	0	0	0	0.028*
	%	100.00%	0.00%	0.00%	0.00%	
Press syndrome	N	1	0	0	2	0.108
	%	33.3%	0.00%	0.00%	66.7%	
APH	N	0	0	1	0	0.362
	%	0.00%	0.00%	100.00%	0.00%	
Wound gape	N	0	1	0	0	0.707
	%	0.00%	100.00%	0.00%	0.00%	

Chi-square test; * indicates significant difference at p<0.05

In our study, 10% of the patient with PIH had IUFD as the complication. 60% of the cases with IUFD had serum uric acid level 8-8.9 mg/dl. 30% of the cases had serum uric acid has uric acid level 9 mg/dl (Table 6). There was statistical difference between serum uric acid level and IUFD (p value was 0.013). 3% of the patients had HELLP syndrome and there is statistical difference between serum uric acid and HELLP syndrome (p value <0.001) (Table 6). 1% of the patients had pancreatitis as a complication. Severity of complication associated with raise in serum uric acid levels.

DISCUSSION

Hypertensive disorders represent the most common medical complication of pregnancy affecting between 7% and 15% of all gestations and account for approximately a quarter of all antenatal admissions.⁵

In a study by Sengodan et al, the prevalence of hypertensive disorders in pregnancy is 10.4%.⁴

Pregnancy Induced Hypertension was most common in age group of 20-25 i.e. 43% followed by age group 25-30 years i.e. 25%.

A study conducted by Parmar et al at NHL municipal college, Ahmadabad, Gujarat noted that PIH is more prevalent among pregnant mother aged less than 20 years of age (53.0%) and 21-30 years (47.0%).⁶ Gandhi et al in their study found that 48.42% of PIH mother was 21-25 years of age group, followed by greater than 30 years of age (25.26%), 14.73% in 26-30 years of age group and 11.57% in less than 20 years of age.⁷ Similarly Bangal et al in their study found majority of PIH mother were in age group of 15-20 years (52.63%) followed by 21-25 years (31.59%), 26-30 years of age (10.52%) and above 30 years (5.26%).⁸ Khosravi et al also noted that 55.6% PIH mother was 21-30 years of age followed by more than 30 years of age (32.2%) and less than 20 years of age (12.2%).⁹

Pregnancy induced hypertension was most common in primi patients (48%) followed by G2 patients (27%), G3 patients (16%). In our study, it was observed that the incidence of pregnancy induced hypertension is decreasing with increase in parity. Similar results found in a study conducted by Patel where the prevalence of PIH was noted more among nulliparous (57.81%) as compared to multiparous (42.18%).⁸ Similar finding was reported by Parmar et al in their study conducted at NHL Municipal College, Ahmadabad 55% in primipara as compared to multipara (45.0%).⁶

The rate of lower segment cesarean section was 50% in our study. The rate of vaginal delivery was 48% in PIH patients. Similarly in a study conducted by Jayaraman, LSCS was observed to be a more common mode of delivery.¹⁰

According to our study, the most common complication was preterm delivery (43%) followed by IUGR (27%). The incidence of placenta abruption and eclampsia was found to be 6% and 15% respectively

The incidence of HELLP syndrome was 3% in our study.

In our study, 42 patients had serum uric acid level between 6-6.9 mg/dl, 24 patients had serum uric acid between 7-7.9 mg/dl, and 24% had serum uric acid level between 8-8.9 mg/dl and 10 patients had serum uric acid level >9 mg/dl. There are 46.8% of severe preeclampsia patients had serum uric acid level between 7-7.9 mg/dl, 31.9% of patients had serum uric acid level 8-8.9 mg/dl. There are 60% of eclampsia patients had serum uric acid more than 8 mg/dl. Lim et al recently documented that mean serum uric acid levels were significantly higher in women with transient hypertension, preeclampsia, and superimposed preeclampsia.¹¹

The study conducted by department of gynecology and obstetrics, Government Medical College, Theni, Tamil Nadu, India. In abnormal uric acid level patients, intrauterine death and HELLP syndrome are observed as statistically significant maternal and fetal complications

In a study conducted at Yenepoya Medical College, Yenepoya University and department of obstetrics and gynaecology. Kasturba Medical College, Mangalore. Karnataka, The mean serum uric acid levels increased proportionately with the severity of the disease. All patients who had abruption were in moderate-severe preeclampsia group with uric acid levels >5.5 mg/dl. In patients with serum uric acid level of >5.5 mg/dl, 86.4% had perinatal deaths and 60% of patients with uric acid levels >5.5 mg/dl had preterm delivery. All cases (100%) of abruptio placentae were seen in moderate-severe preeclampsia group with serum uric acid level >5.5 mg/dl.

In a study conducted at department of obstetrics and gynecology, Hue University of Medicine and Pharmacy, Hue University, Hue, Vietnam. High uric acid level (≥ 393 $\mu\text{mol/l}$, 6.6 mg/dl) resulted in increased risk of preterm birth. uric acid at a threshold of 393 $\mu\text{mol/l}$ was a good prognostic marker for IUGR (OR 5.510, 95% CI 2.611-11.628); preterm birth (OR 3.910, 95% CI 1.696-9.011);

As per study conducted at department of obstetrics and gynecology, JSS Medical College, Mysore, Karnataka, India, 100% maternal deaths, 79.4% with eclampsia, and 71.9% with preterm delivery in hypertensive mothers with uric acid levels >6.0 mg/dl, the uric acid was very significantly higher in severe preeclampsia.

Krishna et al, Thanna et al, Yalamati et al, concluded that high serum uric acid level could be a useful indicator of the maternal and fetal complication which is comparable to our study.¹²⁻¹⁴ Hawkins et al, studied of hypertensive pregnant women (those with pre-eclampsia or gestational hypertension) the risk of adverse maternal outcome and

adverse fetal outcome increased with increasing concentration of uric acid which is compared to our study.¹⁵

As per study conducted by department of obstetrics and gynecology, JLN Medical College, Ajmer, Rajasthan, India, 6% had abruptio placentae, 12% APE, 02% ARF and 04% had PPH in study group as compare to control group all had good outcome which was mean serum uric acid levels in preeclampsia was 7.65±081 mg/dl and 3.21±072 mg/dl in control group.

The study predicts the adverse maternal outcome, intervention to prevent such adverse outcome needs other parameters also such as clinical presentation, age of gestation, other blood investigation.

CONCLUSION

This study shows that the estimation of serum uric acid levels in pregnancies complicated by hypertension and preeclampsia helps assess the severity of the disease and identify life-threatening maternal and fetal complications as a result of preeclampsia/eclampsia.

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Conflict of interest: None declared

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

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