

# The Study of Serum Uric Acid as a Biochemical Indicator for Maternal and Fetal Outcome in Gestational Hypertension

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## Abstract

**Introduction:** Hypertensive pregnancy disorders are among the most common medical disorders during pregnancy and are considered a significant cause of maternal and fetal morbidity and mortality.

**Aim:** The aim of the study was to study of serum uric acid as a biochemical indicator for maternal and fetal outcome in patients with gestational hypertension (GHT).

**Materials and Methods:** This prospective study was conducted in the Department of Obstetrics and Gynaecology, Government Theni Medical College and Hospital, Tamil Nadu, from June 2018 to June 2019 in 200 pregnant women with GHT. Informed consent was obtained from the patients. Results were analyzed statistically and discussed below.

**Results:** Out of 200 pregnant females, the mean age was  $24.2 \pm 4.5$  years. Ninety-four patients were prim gravida, 67 patients were gravida 2, and 30 patients were gravida 3. Ninety-six had GHT with associated abnormalities, 90 were diagnosed with preeclampsia, and 47 had non-severe preeclampsia. In contrast, 43 had severe pre-eclampsia, eight patients had developed eclampsia, while the remaining six subjects were diagnosed with HELLP syndrome. About 66% had serum uric acid level  $\leq 6$  mg/dl and 34% had serum uric acid level  $\geq 6$  mg/dl. In subjects with normal uric acid level, 31.6% and 11.3% of subjects had non-severe preeclampsia and severe preeclampsia. In a subject with increased uric acid level, 46 patients had severe proteinuria. Preterm delivery was more commonly seen in women with serum uric acid higher than 6 mg/dl.

**Conclusion:** Our study concludes that the measurement of serum uric acid levels after 20 weeks of gestation is an excellent diagnostic and prognostic tool to assess fetal outcomes. 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.

**Key words:** Gestational hypertension, Maternal, Fetus, Uric acid

## INTRODUCTION

Hypertensive pregnancy disorders (HDP) are among the most common medical disorders during pregnancy and are considered a significant cause of maternal and fetal morbidity and mortality. In developing countries, HDP ranks second only to anemia with approximately 7–10% of all pregnancies complicated by some form of hypertensive disorder and lead to various maternal and fetal complications.<sup>[1]</sup> In India,

the incidence of preeclampsia, as recorded from hospital statistics, varies widely from 5% to 15%, while eclampsia is about 1.5%.<sup>[2]</sup> Strangely, the exact etiopathogenesis for HDP, including preeclampsia and eclampsia, remains obscured and presents an exciting mystery in obstetric practice.

The diagnosis of preeclampsia is based on the presence of the following clinical features: Blood pressure (BP) 140/90 mmHg after 20 weeks of gestation AND proteinuria 2300 mg/24-h or +1 with the dipstick.<sup>[3]</sup> There may be other associated abnormalities reported which increase the likelihood of preeclampsia occurrence such as elevated serum creatinine (new-onset), platelet count  $<100,000/\mu\text{L}$ , hepatic enzyme abnormalities, persistent headache with or without cerebral or visual disturbances, and epigastric pain. Preeclampsia with the presence of seizures is known as eclampsia.<sup>[4]</sup>

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**Month of Submission :** 10-2020  
**Month of Peer Review :** 11-2020  
**Month of Acceptance :** 11-2020  
**Month of Publishing :** 12-2020

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The elevated uric acid level in maternal blood, presumably due to decreased renal excretion, is frequently found in women with preeclampsia. Of the several hypothesized factors for elevated uric acid in patients with preeclampsia, the following appear to be most intriguing: Abnormal renal function, increased tissue breakdown, acidosis, and increased activity of the enzyme xanthine oxidase/dehydrogenase.<sup>[5]</sup>

An association of uric acid elevation in clinically evident pre-eclampsia has been known since 1917.<sup>[6]</sup> Several studies have correlated the rise in uric acid with the severity of the preeclampsia.<sup>[7]</sup> Although hyperuricemia does correlate with maternal morbidity, there is an even stronger association of increased uric acid with risk for small or low birth weight infants and with overall fetal mortality.<sup>[8-10]</sup>

**Aim**

The aim of the study was to study of serum uric acid as a biochemical indicator for maternal and fetal outcome in patients with gestational hypertension (GHT).

**MATERIALS AND METHODS**

This prospective study was conducted in the Department of Obstetrics and Gynaecology, Government Theni Medical College and Hospital, Tamil Nadu, from June 2018 to June 2019 in 200 pregnant women with GHT.

**Inclusion Criteria**

All pregnant women suffering from GHT, preeclampsia, and eclampsia >20 weeks of gestation were included in the study.

**Exclusion Criteria**

Normotensive pregnant females, patients with hypertension at 20 weeks of gestation (chronic hypertension), patients with chronic renal disease, patients suffering from diabetes mellitus, diagnosed patients of hepatic dysfunction, patients suffering from gout, patients with epilepsy, patients with thyroid dysfunction, patients with cardiac disease, patients with leukemia's, patients with pancreatitis, and patients with hemolysis were excluded from the study.

After obtaining informed written consent from all the study subjects or their attendants (in case of unconscious patients, or patients unable to provide consent due to their condition), relevant data were documented in a pre-defined datasheet. Maintaining all aseptic precautions, blood samples were collected from all subjects to estimate serum uric acid concentration and other parameters.

The data were analyzed using the Statistical Package for the Social Sciences (IBM SPSS Inc.,). Categorical variables

were presented as percentages, and continuous variables were presented as mean/median. The association between categorical variables was tested using the Chi-square test. A P-value (two-tailed) of <0.05 was considered statistically significant.

**RESULTS**

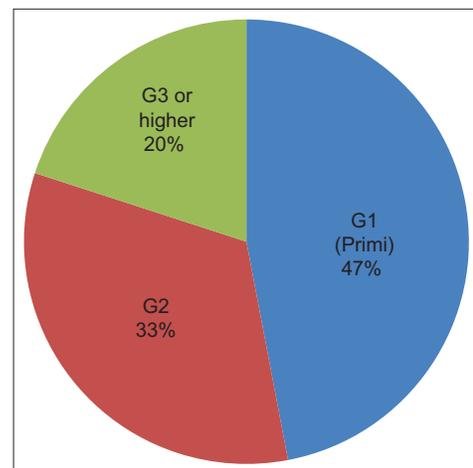
In this study, 200 pregnant patients were included in the mean age of 24.2 ± 4.5 years. Ninety-four patients were prim gravida, 67 patients were gravida 2, and 30 patients were gravida 3 [Figure 1]. The mean BMI was 24.1 ± 3.3 kg/m<sup>2</sup>.

The earliest presentation of GHT in this study was in 25<sup>th</sup> week of gestation (24 weeks 5 days) while the latest presentation was in the 40<sup>th</sup> week of gestation (39 weeks 3 days) [Figure 2].

In 200 patients, 96 had GHT with associated abnormalities. Ninety of the 200 subjects were diagnosed with preeclampsia, 47 had non-severe preeclampsia while 43 had severe preeclampsia. Eight of the 200 subjects developed eclampsia while the remaining six subjects were diagnosed with HELLP syndrome and were considered to be in imminent risk of eclampsia [Figure 3].

**Table 1: Distribution of maternal and fetal complications**

Complications	UA		P-value
	≤6	≥6	
Intra-uterine death	0	10	<0.0001
Intra-uterine growth retardation	13	12	0.128
Intra-cranial hemorrhage	0	0	n/a
Pulmonary edema	0	0	n/a
Abruption	0	2	0.046
Pre-term/low birth weight	66	36	0.701
HELLP syndrome	1	5	0.009
Spontaneous expulsion	0	1	0.167
Maternal death	0	0	n/a



**Figure 1: Distribution of obstetrics score**

Out of 200 patients, 66% had serum uric acid level  $\leq 6$  mg/dl, and 34% had serum uric acid level  $\geq 6$  mg/dl [Figure 4].

In comparing gestational age with serum uric acid level 28 patients with gestational age  $<34$ , 14 patients between 34 and 36, 91 patients greater than 36 had serum uric acid level  $\leq 6$  mg/dl. Twenty-one patients with gestational age  $<34$ , 11 patients between 34 and 36, 35 patients greater than 36 had serum uric acid level  $\geq 6$  mg/dl [Figure 5].

Out of 200 patients, 46 patients with serum uric acid level greater than 6 mg/dl had severe proteinuria [Figure 6].

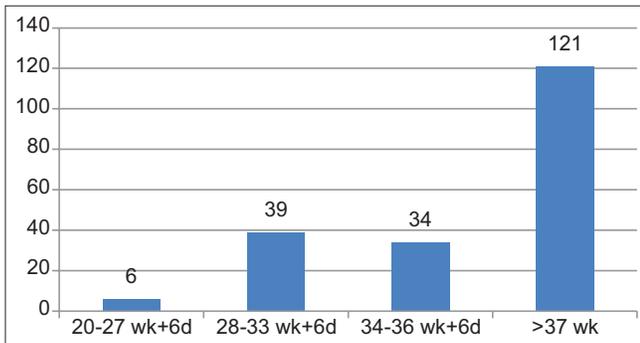


Figure 2: Distribution of gestational age

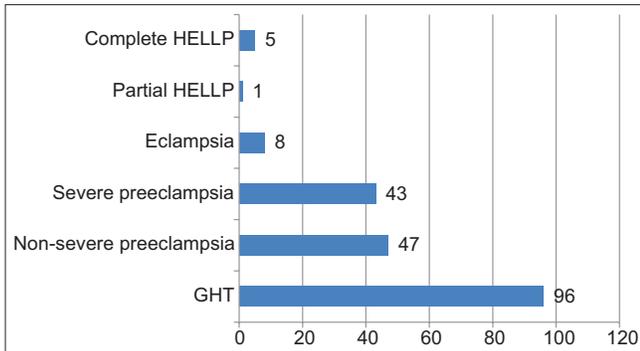


Figure 3: Distribution of diagnosis

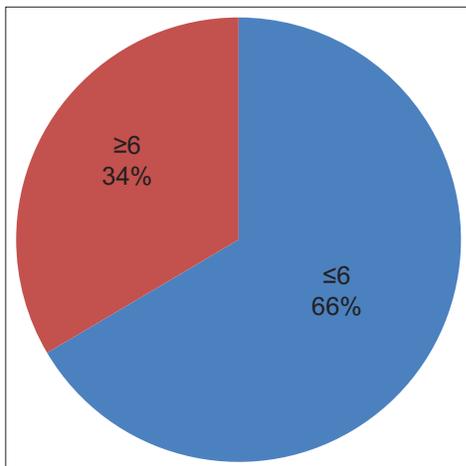


Figure 4: Distribution of serum uric acid levels

In subjects with normal uric acid level, 31.6% and 11.3% of subjects had non-severe preeclampsia and severe preeclampsia ( $P < 0.0001$ ) [Figure 7].

In abnormal uric acid level patients, intrauterine death and HELLP syndrome are observed as statistically significant maternal and fetal complications [Table 1].

## DISCUSSION

Uric acid is filtered by the renal glomeruli, absorbed by the first part of the proximal convoluted tubule, with a further secretion and reabsorption phase.<sup>[11]</sup> Ten percent of the filtered urate is excreted in the urine.<sup>[12]</sup> During pregnancy, uric acid clearance increases from 6–12 mL/min to 12–20 mL/min, with a 25% decrease in blood concentration.<sup>[13-15]</sup>

Lim *et al.*<sup>[16]</sup> recently documented that mean serum uric acid levels were significantly higher in women with transient hypertension, preeclampsia, and superimposed preeclampsia. In Redman's study,<sup>[17]</sup> the best correlation to predict perinatal mortality was the serum uric acid level at 28–32 weeks' gestation. A serum uric acid level of  $\sim 420$   $\mu$ mol/L only predicted perinatal mortality of 6–9% in their group with term pregnancies.<sup>[17]</sup> Plouin *et al.*<sup>[18]</sup> documented a poor perinatal outcome (including stillbirths and neonatal deaths) in pregnancies

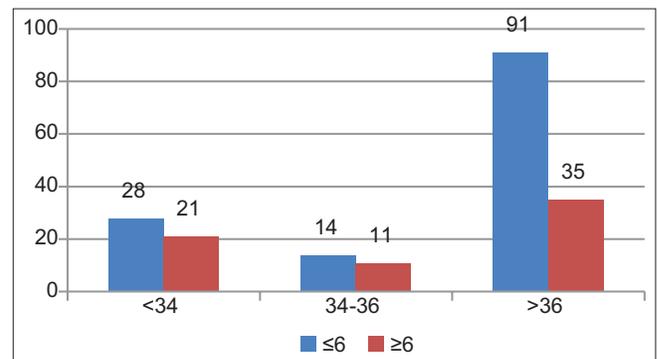


Figure 5: Distribution of gestational age with serum uric acid

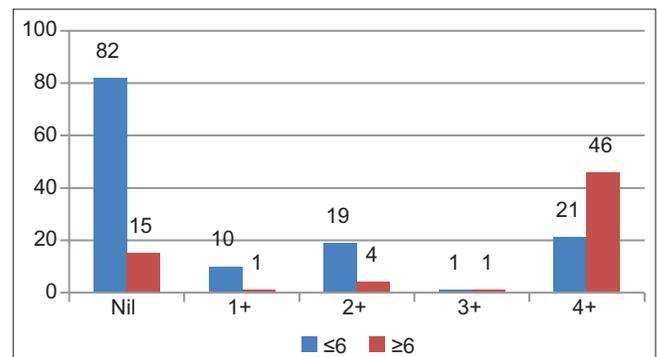


Figure 6: Distribution of proteinuria with serum uric acid

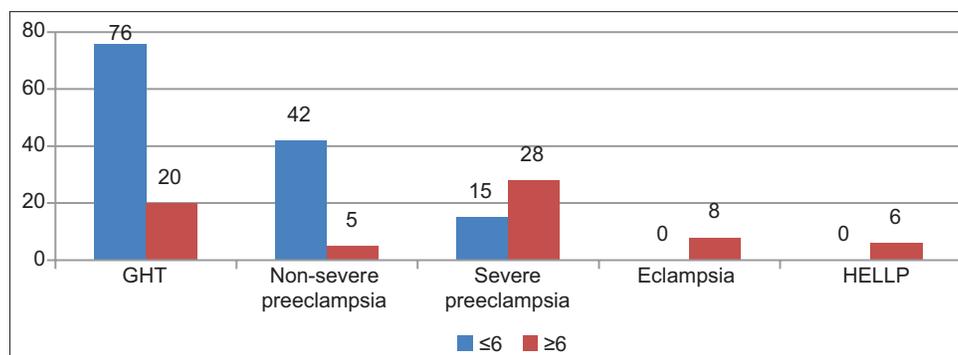


Figure 7: Distribution of gestational hypertension with serum uric acid

complicated by preeclampsia and predicted by serum uric acid levels.

In our study, most hypertensive mothers were in the age group of 20–35 years. Number Indian authors noticed similar age incidence.<sup>[19,20]</sup>

In his study, Robert *et al.*<sup>[21]</sup> showed that 6 % of patients had HELLP syndrome, and 16% had eclampsia. In our study, subjects with normal uric acid level, 31.6% and 11.3% of subjects had non-severe preeclampsia and severe preeclampsia, respectively.

Magann *et al.*,<sup>[22]</sup> there is a positive correlation between increasing/raised SUA level and increased incidence of PNM, stillborn. According to Robert *et al.*,<sup>[21]</sup> the preterm risk is increased in groups of patients with hypertension proteinuria hyperuricemia. Even in the absence of proteinuria, hyperuricemia is a significant risk factor for preterm birth.

## CONCLUSION

Our study concludes that the measurement of serum uric acid levels after 20 weeks of gestation is an excellent diagnostic and prognostic tool to assess fetal outcomes. 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. Since serum uric acid is a very simple analytical tool that can be readily performed at any biochemical laboratory, this is a very cost-effective method to gauge GHT complications and improve maternal and perinatal outcomes.

## REFERENCES

- Barrilleaux PS, Martin JN. Hypertensive therapy during pregnancy. *Clin Obstet Gynecol* 2002;45:22-34.
- Dutta DC. Hypertensive disorders in pregnancy. In: *Textbook of Obstetrics Including Perinatology and Contraception*. 6<sup>th</sup> ed. Calcutta: New Central Book Agency; 2004. p. 221-42.
- Report of the national high blood pressure education program working group on high blood pressure in pregnancy. *Am J Obstet Gynecol* 2000;183:S1-22.
- Sibai BM. Diagnosis and management of gestational hypertension and preeclampsia. *Obstet Gynecol* 2003;102:181-92.
- Johnson RJ, Kang DH, Feig D, Kivlighn S, Kanellis J, Watanabe S, *et al.* Is there a pathogenetic role for uric acid in hypertension and cardiovascular and renal disease? *Hypertension* 2003;41:1183-90.
- Powers RW, Bodner LM, Ness RB, Coper KM, Gallaher MJ, Frank MP, *et al.* Uric acid concentration in early pregnancy among preeclamptic women with gestational hyperuricemia at delivery. *Am J Obstet Gynecol* 2006;194:160-6.
- Daftary SN, Chakravathi S. *Holland and Brews Manual of Obstetrics*. 4<sup>th</sup> ed. Netherlands: Elsevier; 1991. p. 91-8.
- Chamberlain G, Steer P. *Turnbull's Obstetrics*. 3<sup>rd</sup> ed. New York: Churchill Livingstone; 2001. p. 338-44.
- Kleigman RM, Behraman RE, Jenson HB, Staton BF. *Nelson's Textbook of Paediatrics*. 18<sup>th</sup> ed., Vol. 1. Philadelphia, PA: Saunders's Elsevier Publications; 2007. p. 701-4.
- Yassae F. Hyperuricemia and perinatal outcomes in patients with severe preeclampsia. *Iran J Med Sci* 2003;28:198-9.
- Jungers P, Chauveau D. Pregnancy in renal disease. *Kidney Int* 1997;52:871-85.
- Sica DA, Schoolwerth AC. Renal handling of organic anions and cations and renal excretion of uric acid. In: Brenner BM, editor. *The Kidney*. 5<sup>th</sup> ed. Philadelphia, PA: WB Saunders Co.; 1996. p. 607-26.
- Boyle JA, Campbell S, Duncan AM, Greig WR, Buchan WW. Serum uric acid levels in normal pregnancy with observations on the renal excretion of urate in pregnancy. *J Clin Pathol* 1996;19:501-3.
- Chesley L, Williams L. Renal glomerular function in relation to the hyperuricemia of preeclampsia and eclampsia. *Am J Obstet Gynecol* 1945;50:367-75.
- Chesley LC. The movement of radioactive sodium in normal pregnant, non-pregnant and preeclampsia women. *Am J Obstet Gynecol* 1970;6:530-3.
- Lim KH, Friedman SA, Ecker JL, Lu K, Kilpatrick SJ. The clinical utility of serum uric acid measurements in hypertensive diseases of pregnancy. *Am J Obstet Gynecol* 1998;178:67-71.
- Redman CW, Williams GF, Jones DD, Wilkinson RH. Plasma urate and serum deoxycytidylate deaminase measurements for the early diagnosis of preeclampsia. *Br J Obstet Gynaecol* 1977;84:904-8.
- Plouin PF, Chatellier G, Breart G, Hillion D, Moynot A, Tchobroutsky C, *et al.* Factors predictive of perinatal outcome in pregnancies complicated by hypertension. *Eur J Obstet Gynecol Reprod Biol* 1986;23:341-8.
- Nadkarni J, Bahl J, Parekh P. Perinatal outcome in pregnancy-associated hypertension. *Indian Pediatr* 2001;38:174-8.
- Hassan M, Choudhury F, Begum M, Rahman H, Akhter S. Immediate perinatal outcome of neonates with maternal hypertensive disorders in pregnancy. *J Nepal Paediatr Soc* 2013;33:190-5.
- Roberts JM, Bodnar LM, Lain KY, Hubel CA, Markovic N, Ness RB, *et al.*

## Shanthirani and Parimalam: Serum Uric Acid as a Biochemical Indicator in Gestational Hypertension

Uric acid is as important as proteinuria in identifying fetal risk in women with gestational hypertension. *Hypertension* 2005;46:1263-9.

22. Magann EF, Chauhan SP, Naef RW, Blake PG, Morrison JC, Martin J.

Standard parameters of preeclampsia: Can the clinician depend upon them reliably identify the patient with HELLP syndrome? *Aust N Z Obstet Gynaecol* 1993;33:122-6.

**How to cite this article:** Shanthirani B, Parimalam A. The Study of Serum Uric Acid as a Biochemical Indicator for Maternal and Fetal Outcome in Gestational Hypertension. *Int J Sci Stud* 2020;8(9):53-57.

**Source of Support:** Nil, **Conflicts of Interest:** None declared.