

The Clinical Utility of Serum Albumin and Uric Acid Measurements in Preeclampsia and Eclampsia

Shahid A. Mujawar¹, Vinayak W. Patil², Rekha G. Daver³

¹Associate Professor, Department of Biochemistry, Grant Government Medical College and Sir J.J. Group of Government Hospitals, Byculla, Mumbai – 400008, Maharashtra, India.

²Professor and Head, Department of Biochemistry, Grant Government Medical College and Sir J.J. Group of Government Hospitals, Byculla, Mumbai – 400008, Maharashtra, India.

³Professor and Head, Department of obstetrics and Gynecology, Grant Government Medical College and Sir J.J. Group of Government Hospitals, Byculla, Mumbai – 400008, Maharashtra, India.

Received: April 2019

Accepted: April 2019

Copyright: © the author(s), publisher. Annals of International Medical and Dental Research (AIMDR) is an Official Publication of “Society for Health Care & Research Development”. It is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Hypertensive disorder of pregnancy affecting multiple systems and woman has dangerously high blood pressure, swelling, and protein in the urine. Therefore serum albumin and uric acid are useful biochemical markers reflecting the severity of the occurrence of preeclampsia and eclampsia. **Objective:** The aim was to study the role of albumin and uric acid in preeclampsia and eclampsia. **Methods:** This is the case-control hospital based study carried in the Grant Government Medical College and Sir J.J. Group of Government Hospitals, Mumbai. Normotensive pregnant women (n=50) and women with preeclampsia (n=50) and eclampsia (n=50) were included in the study. Both the groups were in their third trimester and of same age and same gestational age. Serum albumin and uric acid were estimated by BCG endpoint and Uricase – PAP method respectively. **Result:** The alterations of serum albumin and uric acid levels in preeclampsia and eclampsia pregnant subjects were found as compared to those of control group. A negative and significant correlation ($r = -0.492$ and -0.602 , $p < 0.001$) was observed between serum albumin with uric acid in study subjects. **Conclusion:** The results suggest that, albumin and uric acid are important factors in the pathogenesis of preeclampsia and eclampsia and are directly related to the severity of disease.

Keywords: Albumin, Uric acid, Normotensive pregnancy, Preeclampsia, Eclampsia.

INTRODUCTION

During pregnancy, the human body undergoes several changes in the process of its alteration to the developing fetus. Although these changes are physiological, there is potential for morbidity and mortality to both mother and fetus.^[1] The main site of renal injury in hypertensive pregnancy is the glomerular endothelial cell. Glomerular dysfunction is characterized by depression of the glomerular filtration rate (GFR), proteinuria, and hypertension.^[2]

Albumin is the protein present in highest concentration in the serum.^[3] Clinically significant excretions of albumin suggest either excessive glomerular filtration or proximal tubular damage. Hospitalized patients with low serum albumin levels experience a fourfold increase in morbidity and six-fold increase in mortality.^[4] Uric acid is the major

product of the catabolism of the purine nucleotides, adenosine and guanosine. Asymptomatic hyperuricemia is frequently detected through biochemical screening; because many are at risk for renal disease that may develop as result of hyperuricemia and hyperuricosuria.^[5]

To determine whether altered concentrations of serum albumin and uric acid were associated with high-risk pregnancy. We studied women serum albumin and uric acid levels in pregnancy induced hypertension (PIH) and compared those with normotensive pregnant controls. We have also find out correlation between these parameters in the study subjects.

MATERIALS AND METHODS

This is the case-control hospital based study was carried out at Department of Biochemistry, Grant Government Medical College and Sir J.J. Group of Government Hospitals, Mumbai over the period of October 2007 to June 2010. All participants completed a medical history form and provided informed consent.

The subjects were pregnant women clinically diagnosed as pregnancy induced hypertension (PIH) patients during the 24-40 weeks with the age 18–35

Name & Address of Corresponding Author

Dr. Shahid A. Mujawar,
Associate Professor,
Department of Biochemistry,
Grant Government Medical College and Sir J.J. Group of
Government Hospitals,
Byculla, Mumbai – 400008, Maharashtra, India.

years visiting the gynecology OPD and wards of the Sir J.J. Hospital, The PIH group (n=100) was further divided into two subgroups. It comprised 50 preeclamptic pregnant women and 50 eclamptic pregnant women on the basis of blood pressure, proteinuria and pathological edema, which are the diagnostic criteria of preeclampsia.

Preeclampsia was diagnosed according to the American College of Obstetrics and Gynecology (ACOG) criteria: blood pressure higher than 140/90 mm Hg and proteinuria more than 300 mg/24 hrs were observed on at least two occasions more than 6 hrs apart after the 20th week of pregnancy. Preeclampsia was classified as severe if blood pressure was higher than 160/110 mmHg, proteinuria more than 5g/24 hrs, and in the presence of headache, visual disturbances, epigastric pain, oliguria, elevated LFT, elevated RFT, thrombocytopenia.[6] Eclampsia was described as convulsions or coma in a preeclamptic woman.[7]

Fifty normotensive pregnant (n=50) subjects who had not having any acute illness, thyroid, liver, and renal diseases were taken as control, who attended to the gynecology OPD were included in the study. The Institutional Ethical Committee at the Grant Medical College and Sir J.J. Group of Government Hospitals, Mumbai, India, approved the study.

Venous blood samples were collected in test tube with aseptic precautions. After 2 hours of collections sample was centrifuged at 3000 rpm for 5 minutes. Serum was separated and collected in polythene tube with cork. The sera with no sign of hemolysis used for the analysis of albumin and uric acid. Serum albumin was measured by BCG endpoint method.[8] Serum uric acid was measured by Uricase -PAP method.[9]

Numerical variables were reported in terms of mean and standard deviation. Statistical analysis of results was done by normal distribution 'z' test. In this analysis, variables showing 'p' value less than 0.05 and 0.001 were considered to be statistically significant and highly significant respectively. Pearson correlation test was used to test correlation.

RESULTS

In our study, the mean age in years and the mean gestational period in weeks were not statistically different in the groups of normotensives, preeclamptics and eclamptics. The study participants did not differ in their socio-demographic characteristics. Hundred percent (100%) of the group with preeclampsia and eclampsia were married The mean weight in kilograms was statistically different in these three groups, being higher for the preeclampsia and eclampsia. The systolic blood pressure (SBP) was significantly higher for the two sub group of PIH subjects than for the normal pregnant group. Similar results were noticed for diastolic blood pressure (DBP).

[Table 1] depicts changes in serum profile when control group was compared individually with study group (preeclampsia and eclampsia). As can be seen, significant decrease (p<0.05) was observed in serum albumin whereas, serum uric acid levels were showed highly significant increase (p < 0.001).

Table 1: Serum albumin and uric acid in normotensive controls and study group (preeclampsia and eclampsia).

Biochemical Parameters	Normotensive pregnant (n = 50)	Preeclampsia (n = 50)	Eclampsia (n = 50)	p Value
Albumin (g/dL)	3.85 ± 0.21	2.89 ± 0.28	2.65 ± 0.22	0.0254 *
Uric acid (mg/dL)	5.71 ± 1.43	7.29 ± 1.28	8.14 ± 1.11	0.0003 **

The values are presented in mean ± S.D. ** P < 0.001, * P < 0.05

[Table 2] showed that there were negative and statistically significant correlation found between serum albumin and uric acid in preeclampsia and eclampsia. Correlation between serum albumin and uric acid in preeclampsia and eclampsia pregnant group showed in Figure 2. Correlation coefficient (r) of them is highly significant (p < 0.001).

Table 2: The correlation between serum albumin and uric acid in pregnancy induced hypertension.

Study group	95% CI of r	r	p
Preeclampsia	- 0.628 to - 0.327	- 0.492	0.0001**
Eclampsia	- 0.714 to - 0.460	- 0.602	0.0001**

** P < 0.001

DISCUSSION

Proteinuria is a major indicator of preeclampsia and also one of the diagnostic criteria of its severity. Proteinuria develops late in the course of the hypertensive disease and its presence is a sign of worsening hypertensive disease, especially preeclampsia.[10]

Statistically significant (p<0.05) decrease in serum albumin level in subjects with preeclampsia and eclampsia were observed as compared to that of normotensive pregnant control group. Misiani R et al. found that hypoalbuminemia in patients with pregnancy induced hypertension and urinary albumin excretion in patients developing PIH was significantly higher than in normal pregnancy from the 28th gestational week onwards.[11] The increased urinary albumin excretion, decreased serum albumin and diastolic blood pressure throughout pregnancy suggesting an important physiologic role of hemodynamic factors in regulating glomerular permeability to albumin. Hypoalbuminemia in preeclampsia is the result of reduced hepatic blood flow, which is secondary to hypovolemia created by higher filtration pressure in the capillaries.[12]

We observed highly significant increase (p<0.001) in serum uric acid level in preeclamptic and eclamptic

cases as compared to that of normotensive pregnant subjects. The mean serum uric acid level of normal pregnant women in the present study (5.71 ± 1.43 mg/dL) was more than the range (3.5-5.1 mg/dL) given by a previous report.^[13] The mean serum uric acid in preeclamptic women was more than normotensive pregnant women. In addition, there was significant difference between normotensive pregnant women and preeclamptic women. The present finding is similar to the findings of previous studies.^[14-16] Elevated serum uric acid levels are due to decreased renal urate excretion which are frequently found in women with preeclampsia.^[17,18] Soluble uric acid impairs nitric oxide generation in endothelial cells. Thus, hyperuricemia can induce endothelial dysfunction.^[19]

In this study, a negative ($r = -0.492$) and statistically significant ($p < 0.001$) relationship was found between serum albumin and uric acid, whereas their 95% confidence interval of 'r' ranged from - 0.628 to - 0.327 in preeclampsia subjects shown in [Figure 1].

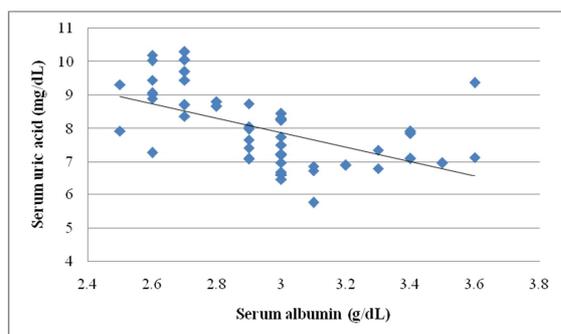


Figure 1: The correlation between serum albumin and uric acid in preeclampsia.

Our study elucidate the relationship between serum albumin with uric acid in eclampsia. A negative and significant correlation ($r = -0.602$, $p < 0.001$) was observed between serum albumin with uric acid in study subjects as per [Figure 2]. Correlation between the serum albumin with uric acid was analyzed statistically using MS-Excel.

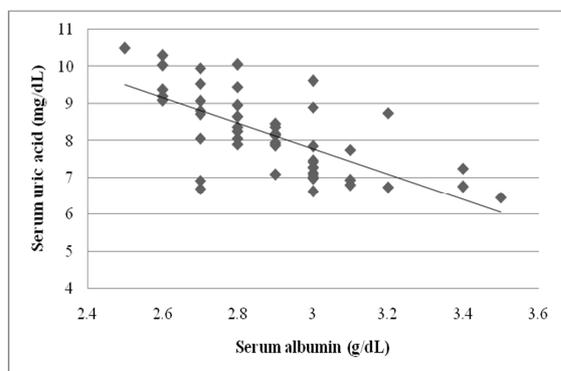


Figure 2: The correlation between serum albumin and uric acid in eclampsia.

Salako et al. found increased plasma albumin levels in preeclampsia compared to normotensive controls.^[20] Gojnic et al. in their study found hypoalbuminemia in severe preeclampsia, which correlated with disease severity.^[21] These findings would suggest a reduction in the synthetic function of the liver in severe preeclampsia. According to Sahijwani D et al. reported that in subjects with preeclampsia who developed convulsions, there consistently was a further rise in the serum uric acid levels. Monitoring of serum uric acid level in those with preeclampsia will facilitate to predict those that will develop eclampsia.^[22]

CONCLUSION

We assume that biochemical screening such as serum albumin and uric acid are of paramount importance in pregnancy. Highly altered levels of the serum albumin and uric acid were found in the preeclamptic and eclamptic group as compared to the healthy normotensive pregnant group. As compared with the preeclampsia group, the level of the serum albumin was significantly reduced and uric acid was significantly higher in the eclampsia group giving the evidences that elevated levels of the serum albumin and uric acid are the valuable marker of preeclampsia and eclampsia as opposed to have a role in the pathogenesis and also indicates that the severity of disease increases as the disease progresses from preeclampsia to eclampsia. A large study is recommended to properly define the value of serum albumin and uric acid levels in pregnancy in the prediction of renal and liver diseases in the light of the findings of this study.

REFERENCES

- Mitra AK, Patki PS, Mitra SK. Liver disorders during pregnancy and their management. *The Antiseptic*. 2008;105 (4): 193-196
- Hladunewich MA, Derby GC, Lafayette RA, Blouch KL, Druzin ML, Myers BD. Effect of L-Arginine Therapy on the Glomerular Injury of Preeclampsia. A Randomized Controlled Trial. *Obstet Gynecol*. 2006;107:886-895.
- Keyer JW. Human plasma proteins. New York: Wiley. 1979:280-287.
- Forse PA, Shizgal HM. Serum albumin and nutritional status. *J Parenter Enteral Nutr*. 1980; 4: 450-454.
- Newman DJ, Price CP. Renal function and nitrogen metabolites. In: Burtis CA, Ashwood ER, eds. *Tietz textbook of clinical chemistry*. 1st edn. Harcourt Brace and Co.1999; 1204-1270.
- American College of Obstetrics and Gynecology (ACOG) Practice Bulletin No. 202 Gestational Hypertension and Preeclampsia. *Obstetrics & Gynecology*, Washington, 2019.
- American college of Obstetrics and Gynecology (ACOG) technical bulletin 219: Hypertension in pregnancy, *Obstetrics & Gynecology*, Washington, 1996.
- Doumas BT, Watson WA, Biggs HG. Albumin standard and the measurement of serum albumin with bromocresol green. *Clin Chem Acta*.1971; 31: 87-97.

Mujawar et al; Serum Albumin and Uric Acid Measurements in Preeclampsia and Eclampsia

9. Gochman N, Schmitz JM. Automated determination of uric acid with use of a uricase – peroxidase system. *Clin Chem*. 1971; 17: 1154-1158.
10. Rodriguez-Thompson D, Lieberman ES. Use of a random urine albumin/creatinine ratio for the diagnosis of significant proteinuria during pregnancy. *Am J Obstet Gynecology*. 2001; 185: 808–811.
11. Wilson JD, Foster DW, eds. *Williams textbook of endocrinology*. Philadelphia: Saunders, 1992.
12. Ueland PM, Refsum H, Stabler SP. Total homocysteine in plasma or serum: Methods and clinical applications. *Clin Chem*. 1993;39:1764-1779.
13. Lim KH, Friedman SA, Ecker JL, Kao L, Kilpatrick SJ. The clinical utility of serum uric acid measurements in hypertensive diseases of pregnancy. *Am J Obstet Gynecol*. 1998; 178: 1067-1071.
14. Szmidi-Adjide V, Vendittelli F, David S, Bredent-Bangou J, Janky E. Calciuria and preeclampsia: a case-control study. *Eur J Obstet Gynecol Reprod Biol*. 2006; 125: 193-198.
15. Williams KP, Galerneau F. The role of serum uric acid as a prognostic indicator of the severity of maternal and fetal complications in hypertensive pregnancies. *J Obstet Gynaecol Can*. 2002; 24: 628-632.
16. Gulati R. Raised serum TNF-alpha, blood sugar and uric acid in preeclampsia in third trimester of pregnancy. *J Nepal Med Assoc*. 2005; 44: 36-38.
17. Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Gilstrap LC III, Wenstrom KD. *Williams obstetrics*. 22nd ed. New York: McGraw-Hill. 2005: 761-808.
18. Kang DH, Finch J, Nakagawa T, Karumanchi SA, Kanellis J, Granger J, et al. Uric acid, endothelial dysfunction and preeclampsia: searching for a pathogenetic link. *J Hypertens*. 2004; 22: 229-235.
19. Khosla UM, Zharikov S, Finch JL, Nakagawa T, Roncal C, Mu W, et al. Hyperuricemia induces endothelial dysfunction. *Kidney Int*. 2005; 67: 1739-1742.
20. Salako BL, Odukogbe AT, Olayemi O, Adedapo KS, Aimakhu CO, Alu FE, et al. Serum albumin, creatinine, uric acid and hypertensive disorders of pregnancy. *East Afr Med J* 2003;80:424-428.
21. Gojnic M, Petkovic S, Papic M, Mostic T, Jeremic K, Viledecic Z, et al. Plasma albumin level as an indicator of severity of preeclampsia. *Clin Exp Obstet Gynecol*. 2004;31:209-210.
22. Sahijwani D, Desai A, Oza H, Kansara V, Ninama P, Maheshwari K, et al. Serum Uric Acid as a Prognostic Marker of Pregnancy induced Hypertension. *Journal of South Asian Federation of Obstetrics and Gynaecology JSAFOG*. 2012;4(3):130-133.

How to cite this article: Mujawar SA, Patil VW, Daver RG. The Clinical Utility of Serum Albumin and Uric Acid Measurements in Preeclampsia and Eclampsia. *Ann. Int. Med. Den. Res*. 2019; 5(3):BC16-BC19.

Source of Support: Nil, **Conflict of Interest:** None declared