ORIGINAL RESEARCH

A PROSPECTIVE STUDY OF SERM CALCIUM, MAGNESIUM, URIC ACID AND LIVER ENZYMES IN PREGNANCY INDUCED HYPERTENSION

Dr.Borra Dharmendhar[1], Dr.Laxmi Chapidi[2], Dr.Ketham Veera Sudhakar[3], Dr.Kankata Jhansi Rani[4*]

[1]Associate Professor, Department of Biochemistry, Government Medical College and Hospital, Ramagundam.

[2]Assistant Professor, Department of Obstetrics and Gynecology, Government Medical College and Hospital, Ramagundam.

[3]Associate Professor, Department of Biochemistry, Government Medical College and hospital, Wanaparthy.

4*Associate Professor, Department of Obstetrics and Gynecology Kakatiya Medical College and MGM hospital, Warangal.

Corresponding Author: Dr.Kankata Jhansi Rani

Associate Professor, Department of Obstetrics and Gynecology Kakatiya Medical College and MGM hospital (Mahatma Gandhi Memorial Hospital), Warangal.

E Mail: jhansi.kankata@gmail.com

Abstract

Introduction: Hypertensive disorders in pregnancy (HDP) are one of the deadly triads, along with hemorrhage and infection, and are responsible for 10.8% of maternal mortality in India. In preeclampsia and eclampsia, significant changes are seen in various biochemical parameters like uric acid and serum calcium. Hyperuricemia due to oxidative stress is associated with deleterious effects on endothelial dysfunction, oxidative metabolism, platelet adhesiveness, and aggregation. Hence, elevated serum uric acid is highly predictive of increased risk of adverse maternal and fetal outcomes. Blood calcium has a relaxant effect on the blood vessels of pregnant women.

Materials and Methods: A prospective study was conducted at the department of Obstetrics and Gynecology, Kakatiya Medical College and MGM hospital, Warangal from 1st October 2021 to 30th September 2022 (1 year). We have selected 100 cases and 100 controls. The control group was women who fulfill the same previously mentioned criteria, but who did not develop hypertension during the 3rd trimester. They were all normotensive with a systolic blood pressure of 130 mmHg or less and a diastolic blood pressure of 80 mm Hg or less.

Results: The present study includes 100 cases with pregnancy induced hypertension and 100 controls with normal healthy pregnancy. Age Distribution in Study Population Mean ± SD of age showed no significant difference with Mean ± SD of cases at 22.62 ± 3.61 yrs. compared to that of controls at 23 ± 4.04 yrs. and a p-value of 0.62. Gestational Age in Study

Population Mean gestational age showed high significance with Mean ± SD of cases at 36.38 ± 4.19 weeks compared to that of controls at 39.62 ± 1.16 weeks with a p value of < 0.001.

Conclusion: Possibly, serial measurements of the serum uric acid and liver enzymes from early pregnancy can bring forward a selected group of high risk women for treatment. Thus, it can be concluded that Calcium and Magnesium can be evaluated at an early date so that such mineral deficiencies can be treated by appropriate Calcium and Magnesium supplements. Uric acid and Liver enzymes can possibly be used as biomarkers for identifying and avoiding adverse pregnancy outcomes by prompt intervention.

Key Words: Hypertensive disorders in pregnancy, Hyperuricemia, serum uric acid, systolic blood pressure, diastolic blood pressure.

INTRODUCTION

Hypertensive disorders in pregnancy (HDP) are one of the deadly triads, along with hemorrhage and infection, and are responsible for 10.8% of maternal mortality in India.[1] In preeclampsia and eclampsia, significant changes are seen in various biochemical parameters like uric acid and serum calcium. Hyperuricemia due to oxidative stress is associated with deleterious effects on endothelial dysfunction, oxidative metabolism, platelet adhesiveness, and aggregation.[2] Hence, elevated serum uric acid is highly predictive of increased risk of adverse maternal and fetal outcomes. Blood calcium has a relaxant effect on the blood vessels of pregnant women.[3]

Around 10% of all pregnant women in the world suffer from hypertensive disorders of pregnancy. Hypertensive disorders of pregnancy include pre-eclampsia and eclampsia, gestational hypertension and chronic hypertension.[4] Pregnancy-related hypertensive conditions are a leading cause of extreme acute morbidity, long-term impairment, and death in mothers and infants. Pre-eclampsia is unique among hypertensive disorders in terms of the effects it has on maternal and neonatal health.[5] It is a leading cause of maternal and perinatal mortality and morbidity around the world. It affects 4-8 percent of all pregnancies. Preeclampsia is a leading cause of maternal mortality in developing countries with inadequate access to health care, with estimates of >60,000 maternal deaths each year.[6]

The aim and objectives of the study is to determine the clinical value of serum calcium, magnesium, uric acid and liver enzymes in preeclampsia. To estimate and compare the levels of serum calcium, magnesium, uric acid and liver enzymes in women with preeclampsia and normal pregnant women. To find if there is any relationship between serum calcium, magnesium, uric acid and liver enzymes in the study group.

MATERIALS AND METHODS

Study design: A prospective study.

Study location: A prospective study was conducted at the department of Obstetrics and Gynecology, Kakatiya Medical College and MGM hospital, Warangal.

Study duration: 1st October 2021 to 30th September 2022 (1 year).

Sample size: We have selected 100 cases and 100 controls.

Selection criteria:

Case group:

- Pregnant females with a singleton pregnancy.
- Age range between 18 and 35 years.
- Gestational age: All women in the 3rd trimester, the gestational period ranged from 30 - 42 weeks. Calculated from the first day of the last menstrual period.
- No history of previous urinary tract troubles and no evidence of UTI.
- Not diabetic.

Control Group: The control group was women who fulfill the same previously mentioned criteria, but who did not develop hypertension during the 3rd trimester. They were all normotensive with a systolic blood pressure of 130 mmHg or less and a diastolic blood pressure of 80 mm Hg or less.

Exclusion criteria: In both cases and control groups, the exclusion criteria included pregnant females with disorders such as chronic renal disease, chronic hypertension, heart disease, gestational diabetes, molar pregnancy, intrauterine foetal death, urinary tract infection and twin pregnancy.

The blood pressure was measured by the sphygmomanometer, while the patient was lying on a couch on her side. The reading should be 140/90 mmHg and above-

- The serum calcium, magnesium, uric acid and liver enzymes estimated using Robonik semi-automated analyser.
- Measurement of calcium in serum was done using Ortho Cresolphthale in complexone method (OCPC method).
- Measurement of magnesium was done using Xylidyl Blue Method.
- Measurement of uric acid was done using Modified Trinder Method.
- Measurement of ALP, AST and ALT was done using enzymatic method.

Statistical Methods: All findings were tabulated and statistically analysed using paired t-test using SPSS version 16.0. Mean and SD were calculated for age, gestational age, parity, birth weight and all the biochemical parameters. Significant level was set as $p<0.05$. Numerical variables were presented as Mean ± Standard Deviation (Mean ± SD), while categorical variables were presented as percentages. Continuous variables were compared using Student's 't' test. Student's't' test with unequal variance was used to compare means between two groups at 5% level of significance. Correlation analysis was done by using Pearson correlation analysis.

RESULTS

The present study includes 100 cases with pregnancy induced hypertension and 100 controls with normal healthy pregnancy. Age Distribution in Study Population Mean ± SD of age showed no significant difference with Mean ± SD of cases at 22.62 ± 3.61 yrs. compared to

that of controls at 23 ± 4.04 yrs. and a p-value of 0.62. Gestational Age in Study Population Mean gestational age showed high significance with Mean ± SD of cases at 36.38 ± 4.19 weeks compared to that of controls at 39.62 ± 1.16 weeks with a p value of < 0.001.

	PIH Cases (n= 100)	Controls (n= 100)	P-Value
Gestational age at admission for delivery	36.38±4.19	39.62±1.18	0.001

Table 1: Mean ± SD Values of Gestational Age in Study Population

	PIH Cases (n= 100)	Controls (n= 100)	P-Value
Systolic Blood Pressure (in mmHg)	150.3±19.30	109.6±7.35	0.001
Diastolic Blood Pressure (in mmHg)	100.6±12.10	75.4±5.30	0.001

Table 2: Mean ± SD Values of Blood Pressure in Study Population

	PIH Cases (n= 100)	Controls (n= 100)	P-Value
Calcium (mg/dL)	8.56±0.82	9.88±1.38	0.001
Magnesium (mg/dL)	1.92±0.35	2.26±0.25	0.001

Table 3: Mean ± SD Values of Calcium and Magnesium in Study Population

Parameter	PIH Cases (n= 100)	Controls (n= 100)	P-Value
Uric Acid (mg/dL)	6.66±2.22	4.52±1.19	0.001

Table 4: Mean ± SD Values of Uric Acid in Study Population

Biochemical Parameter (IU/L)	PIH Cases (n= 100)	Controls (n= 100)	P-Value
ALP	180.4±49.23	95.6±49.21	0.001
SGOT/AST	54.7±31.58	25.09±7.28	0.001
SGPT/ALT	36.7±28.45	18.56±10.37	0.001

Table 5: Mean ± SD Values of Liver Enzymes in Study Population

DISCUSSION

The Mean ± SD of gestational ages of the preeclamptic women and the normal healthy women are significantly different as is shown in Table 1. The present study showed a Mean ± SD of 36.38 ± 4.19 weeks in cases and 39.62 ± 1.18 weeks in controls with a highly significant p-value of < 0.001, which correlates with the study of Deepa V Kanagal et al and of Harma et al, Farah Saleh et al and Chaurasia et al. Mean ± SD of systolic BP (153±19.39 mmHg vs. 109.6±7.55 mmHg) and Mean ± SD of Diastolic BP (102.4±13.99 mmHg vs. 75.4±5.30 mmHg) of the preeclamptic group are significantly higher than the control group (p < 0.001) as shown in Table 2, which correlates well with the study of Rubina Aziz et al and also with the study of Deepa V Kanagal et al and Farah Saleh et al.[7]

The present study has shown that maternal total serum calcium levels are significantly lower in pregnancy induced hypertension than in normal pregnant women as shown in Table 3 with Mean ± SD of 8.57 ± 0.96 mg/dL in preeclamptic pregnant women and a Mean ± SD of 9.88 ± 1.38 mg/dL in controls with a highly significant p-value of < 0.001. These results are in accordance with the findings of Naser et al and Sendhav Sandip et al.[8]

The present study has shown that maternal total serum magnesium levels can be significantly lower in pregnancy induced hypertension than in normal pregnant women as shown in Table 3 with Mean ± SD of 1.93 ± 0.34 mg/dL in pregnant women and a Mean ± SD of 2.26 ± 0.25 mg/dL in controls with p-value of < 0.001. This study was similar to the findings of previous studies by C Punthumapol et al,(14) Sendhav Sandip et al, Zohreh Tavana et al and Handwerker SM et al, Khan AMC and Sullivan et al.[9]

The present study Mean ± SD (Cases- 6.66 ± 2.21 mg/dL/ Controls- 4.51 ± 1.18 mg/dL) showed that mean uric acid levels are significantly higher in hypertensive patients when compared with controls as shown in Table 4. This finding is in accordance with the study done by Punthumapol C et al, Sendhav Sandip et al, Sangeeta N et al and Cunningham F et al. But Thangaratinam et al concluded from a meta-analysis that uric acid level measurement in pregnant women is not a strong predictive factor.[10]

The present study showed a significant increase in the value of ALT with a Mean ± SD of 36.7 ± 28.77 IU/L in cases and 18.56 ± 10.42 IU/L in controls with a p-value of < 0.001 as shown in Table 5. This correlates with the study of Paneri et al and Dipti Mohapatra et al. Thus, estimation of serum ALP, AST, ALT and Uric acid at regular interval may give insight to ongoing disease progression and organ damage. They may prove to be a useful tool to predict the maternal and foetal complications even at an earlier stage of the disease.

CONCLUSION

Possibly, serial measurements of the serum uric acid and liver enzymes from early pregnancy can bring forward a selected group of high risk women for treatment. Thus, it can be concluded that Calcium and Magnesium can be evaluated at an early date so that such mineral deficiencies can be treated by appropriate Calcium and Magnesium supplements. Uric acid and Liver enzymes can possibly be used as biomarkers for identifying and avoiding adverse pregnancy outcomes by prompt intervention.

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