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Study of Serum Calcium, Magnesium, Uric Acid and Liver Enzymes in Preeclampsia

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Abstract:
Introduction: *Pre-eclampsia is one of the major causes of maternal and fetal morbidity and mortality. Though the etiology is obscure, recent studies indicate that serum levels of calcium and magnesium may have a role in pre-eclampsia.*
Materials and methods: *The study included 60 subjects of age group 18-35 years, attending the Department of Biochemistry, M.G.M Medical College, Jamshedpur, out of which 30 were pre-eclampsia women with gestational age of ≥20 weeks (Case group) and rest 30 were normal pregnant women of same gestational age (Control group).*
Results: *The serum calcium concentration was significantly lower in the pre-eclamptic group compared to normotensives (8.47 ± 0.27 mg/dl Vs 9.60 ± 0.57 mg/dl) whereas the levels of serum magnesium showed a marginal difference in both the groups. (1.59± 0.21 mg/dl Vs, 2.67 ± 0.30 mg/dl), in uric acid levels (7.09±0.65 mg/dl Vs 4.5 ± 0.56 mg/dl). The study also showed that pre-eclampsia women were older, their BMI was higher and birth weight of babies lower compared to normotensives.*
Conclusion: *Serum calcium, magnesium and uric acid can be considered as factors having a role in the etiopathogenesis of the disease. Thus, assessment of these parameters is useful in the early diagnosis of pre-eclampsia.*
Key words: *pre-eclampsia, Serum calcium, magnesium and uric ac*id.

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I. Introduction

Preeclampsia is one of the commonest etiologies of fetal and maternal mortality and morbidity.[1] The incidence of preeclampsia in developing nations is estimated to be 4–18%.[2] Thus, 16% of all maternal mortality in developed countries and 9% of maternal mortalities in Asia and Africa are said to be due to hypertensive disorders in pregnancy.[3] Moreover, 18% of 724 total maternal deaths at the Korle-Bu Teaching Hospital between 1984 and 1994 were due to hypertensive disorders in pregnancy, including preeclampsia.[4] A worldwide perinatal and neonatal mortality rate of 10% is associated with preeclamptic disorders, with prematurity as the commonest cause of the neonatal deaths.[5] Current evidence suggests that the endothelial dysfunction seen in preeclamptic pregnant women may persist years after the episode, and therefore preeclamptic women may be at high risk of cardiovascular diseases later in life.[6]

Though the etiology of preeclampsia remains unclear, many theories suggest abnormal placental implantation and abnormal trophoblastic invasion as possible causes.[7] The molecular basis of this condition is unresolved in literature.8 It has been postulated that fluctuations in maternal serum ions may be the precipitating cause of elevated blood pressures in preeclampsia.[9,10] Dietary deficiency of mineral ions has been shown to have a harmful effect on the pregnant mother and growing fetus and possibly complicate preeclampsia.[11] Dietary deficiency of magnesium has been established to play a role in blood pressure regulation and hence development of preeclampsia.[12] Evidence supporting routine magnesium supplementation for all pregnant women has not been substantiated by research, though most studies have reported reduced magnesium levels in pregnancy and worse levels in preeclampsia.[13] However, other studies have also reported a nonsignificant change in the serum magnesium levels of preeclamptic women compared to normal pregnant women.[14]

Various studies have also reported reduced serum calcium levels in preeclampsia compared to normal pregnant women. Calcium supplementation has been reported to half the risk of development of preeclampsia. Kanagal et al, in their study on calcium supplementation in pregnancy, recognized that daily calcium supplementation of 1.5–2 g reduced the blood pressure, prevented the development of preeclampsia in normotensive pregnant women as well as reduced morbidity and mortality, a finding supported by Hofmeyr et al in their systematic review on calcium supplementation in pregnant women at the community level. Other

studies, however, noted a nonsignificant difference in serum levels of calcium in preeclampsia compared to normotensive pregnant women. In a prospective study, Levine et al also observed that calcium supplementation during pregnancy does not prevent the development of preeclampsia in healthy nulliparous women.

The serum calcium, uric acid and magnesium picture in preeclampsia remains uncertain. We therefore sought to compare serum total calcium, uric acid and magnesium levels of preeclamptic and normal pregnant women at the Department of Biochemistry, M.G.M Medical College, Jamshedpur.

II. Materials and Methods

This study was conducted in the Department of Biochemistry, in collaboration with the Department of Obstetrics and Gynecology at M.G.M Medical College, Jamshedpur, India. Informed consent was taken from all subjects. The study was conducted from April 2015 to March 2016.

Subjects:

A total of 100 study subjects ranging in age from 18-36 years, attending antenatal clinic of Obstetrics & Gynecology Department were enrolled in the present study. Out of 100 subjects, 50 were pre-eclamptic women (Group A) and 50 were normal pregnant women (Group B).

Inclusion Criteria:

Group-I (Cases):-The study includes 50 pre-eclamptic women with gestational age of ≥20 weeks. The diagnosis of pre-eclampsia was based on the definition of American College of Obstetrics and Gynecologists. [12]
(A) Systolic blood pressure greater than 140 mm Hg or a rise of at least 30 mmHg or
(B) Diastolic blood pressure greater than 90 mm Hg or a rise of at least 15 mmHg (manifested on two occasions at least 6 hours apart) and
(C) Proteinuria of 300 mg or greater in 24 hours urine collection or protein concentration of 1 gm/L (on two occasions of at least 6 hours apart).

Group-II (Controls):- 50 normal pregnant women of same gestational age without a history of any systemic illness belonging to the same socio-economic status were considered as controls. Subjects with normal pregnancy were normotensive and had no proteinuria.

Exclusion criteria:

Women having renal disease, liver disease, cardiovascular disease, severe anemia, diabetes, systemic or endocrine disorders, twin pregnancies, known hypertension, women who are taking medication, or other pre-existing medical conditions which alter study parameters were excluded from the study.

Collection of Blood Sample: About 3-5 ml of venous blood from all subjects was collected in clean, disposable plastic tubes aseptically from anterior antecubital vein. It was allowed to clot for few minutes and was subjected to centrifugation for 10 minutes at 3000 rpm to separate the serum and kept at -200 C until analysis was carried out.

Measured Parameters:

The following parameters were estimated in the present study-
1. Serum Calcium by O-Cresolphthalein Complexone [OCPC] method.
2. Serum Magnesium by Calmagite colorimetric method.
3. Serum Uric acid by uricase method.

Statistical analysis:

Results were statistically analyzed by „GraphPadQuickCals t-test calculator". Student"s t-test was used to assess the significance of difference between the groups. All results are presented as mean ± S.D. A 'p' value of less than 0.001 was considered significant.

III. Results

The mean calcium levels in pre-eclamptic women and normal pregnant women are 8.47±0.27 mg/dl and 9.60±0.57 mg/dl respectively. Calcium is significantly low in pre-eclamptic women compared to normal pregnant women (P<0.001). The mean magnesium levels in pre-eclamptic women and normal pregnant women are 1.56±0.21mg/dl and 2.67±0.30 mg/dl respectively. There is significant decrease in magnesium levels (P<0.001) in pre-eclamptic women as compared to normal pregnant women. The mean uric acid levels in pre-eclamptic women and normal pregnant women are 7.09±0.65 mg/dl and 4.5±0.56 mg/dl respectively. There is significant elevation of uric acid (P<0.001) in study group in comparison to normal pregnant women.

Age in years	Group A	Group B
15-19	**9 (18%)**	**6 (12%)**
20-24	**24 (48%)**	**31 (62%)**
25-29	**9 (18%)**	**10 (20)**
30-35	**8 (16%)**	**3 (6)**
Total	**50 (100%)**	**50 (100%)**

Table 1: Age distribution among treatment groups

Parameter	Group A	Group B
Gestational age at admission for delivery	33.67±3.87	37.26±2.98

Table 2: Mean Values of Gestational Age in Study Population

Parameter	Group A	Group B
Systolic BP (mm of hg)	149.76±12.67	108.6±6.6
Diastolic BP (mm of hg)	105.6±5.6	77.6±3.4

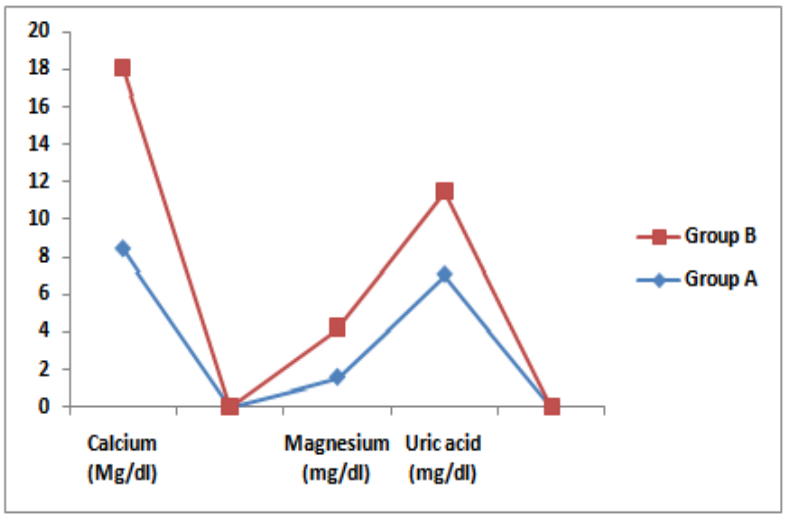
Table 3: Mean Values of Blood pressure in Study Population

Parameter	Group A	Group B
Calcium (Mg/dl)	8.47 ± 0.27	9.60 ± 0.57
Magnesium (mg/dl)	1.59± 0.21	2.67 ± 0.30
Uric acid (mg/dl)	7.09±0.65	4.5 ± 0.56

Table 4: Mean Values of calcium, magnesium and uric acid in Study Population

Parameter	Group A	Group B
ALP	179.76±32.67	94.3±1.78
SGOT/AST	53.76±25.78	24.76±5.8
SGPT/ALT	35.9±26.33	18.75±10.21

Table 5: Mean Values of liver enzymes in Study Population



Graph 1: Mean Values of calcium, magnesium and uric acid in Study Population

IV. Discussion

The present study was undertaken to compare the changes which may occur in the levels of serum calcium,magnesium and uric acid in pre-eclamptic patients and normal pregnant women.

Serum magnesium level in pre-eclampsia patients in our study was decreased significantly ($p<0.001$) compared to healthy pregnant women. This was in agreement with Sandip et al and Lambe et al. Reduction in the level of extracellular magnesium causes partial membrane depolarization and decreased repolarization along with opening of membrane calcium channels leading to shift of calcium intracellularly. This phenomenon produces vasoconstriction and rise in the blood pressure.[14] Further it has been said that low serum magnesium increases endothelin-1 mediated smooth muscle contraction and hampers the release of prostacyclin from the endothelial cells of the umbilical arteries again manifesting as increase in the blood pressure.

In the present study, there was significant increase in the levels of serum uric acid in pre eclamptic women as compared to normal pregnant women. This was in agreement with previous studies done by Sandipet al, Bhaskar et al. The increase in serum uric acid has been mainly secondary to reduced renal urate clearance because of renal dysfunction. Soluble uric acid impairs nitric oxide generation in endothelial cells. Thus, hyperuricemia can induce endothelial dysfunction.

V. Conclusion

Based on the present study, as serum calcium and magnesium levels are low in preeclamptic mothers and considering the high prevalence of preeclampsia, nutritional conditions of pregnant women seems to be of prime importance. Pregnant women should be educated about nutrition during pregnancy and probable risks of inappropriate diet should be informed.

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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