|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2019: 79.34
Original Research Article
Volume 5, Issue 8; August: 2021; Page No. 183-187

COMPARATIVE STUDY OF SERUM CALCIUM, MAGNESIUM, URIC ACID AND GLUCOSE IN PREECLAMPSIA AND NORMAL PREGNANT WOMEN OF MALWA REGION OF MADHYA PRADESH

Dr Darshna Jain[1], Dr. Mohit Kulmi[2], Dr Prachi Paliwal[3], Dr Manoj Narayan Paliwal[4]

[1]Assistant Professor, Biochemistry, Govt. Medical College Ratlam, (MP)
[2]Assistant Professor, Department of Pharmacology, Govt. Medical College Ratlam, (MP)
[3]Associate Professor, Biochemistry, SAIMS, Indore, (MP)
[4]Professor, Biochemistry, Govt. Medical College Ratlam, (MP)

Article Info: Received 16 June 2021; Accepted 06 August 2021
DOI: https://doi.org/10.32553/ijmbs.v5i8.2108
Corresponding author: Dr. Mohit Kulmi
Conflict of interest: No conflict of interest.

Abstract

Background: Comparative study of serum calcium, magnesium, uric acid and glucose in preeclampsia and normal pregnant women of malwa region of Madhya pradesh

Methods: For the Study, a total of 100 women ranging in age from 18-35 years were recruited. They were divided in two groups. 50 were pre-eclamptic women with gestational age of ≥20 weeks (Case group) and rest 50 were normal pregnant women of same gestational age (Control group).The levels of magnesium, calcium, glucose, and uric acid in the blood were measured.

Result: Serum calcium and magnesium levels were significantly lower ($p<0.001$) in the pre-eclamptic group, whereas serum uric acid levels were significantly higher ($p0<001$) in preeclamptic group. The level of serum glucose was raised in preeclampsia.

Conclusion: serum levels of calcium, magnesium, uric acid and glucose are altered in pre-eclampsia, implying that these factors may play a role in the aetiology and severity of pre-eclampsia.so assessing the serum level of this parameters will aid in the early detection of pre-eclampsia.

Keywords: Calcium, Magnesium, Uric acid, Glucose, Pre-eclampsia, Pregnancy

Introduction

Around 10% of all pregnant women in the world suffer from hypertensive disorders of pregnancy (1). hypertensive disorders of pregnancy include pre-eclampsia and eclampsia, gestational hypertension and chronic hypertension (2).Pregnancy-related hypertensive conditions are a leading cause of extreme acute morbidity, long-term impairment, and death in mothers and infants. (3)Pre-eclampsia is unique among hypertensive disorders in terms of the effects it has on maternal and neonatal health. It is a leading cause of maternal and perinatal mortality and morbidity around the world (4).It affects 4-8 percent of all pregnancies. (5).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).According to WHO"s World Health Report 1998, Preeclampsia is defined as "the development of hypertension (>140/90mm of Hg) after 20 weeks of pregnancy in awoman with proteinuria with or without edema and without previous history of hypertension" (7).Visual abnormalities, oliguria, eclampsia, hemolysis, elevated liver enzymes, thrombocytopenia, pulmonary oedema, and foetal growth restriction are all possible complications (8).The pathophysiological process is characterized by trophoblastic invasion failure of the spiral arteries, which may be linked to increased uterine artery vascular resistance and decreased placental perfusion. (9).Recent research has found a connection between hypertensive complications and changes in the concentration of various biochemical parameters in pre-eclamptic women, such as serum uric acid, calcium, and magnesium.Calcium is essential for muscle contraction as well as for control of water balance in cell. A change in plasma calcium concentration leads to the alteration of blood pressure. The decreased serum calcium and the increased intracellular calcium can cause an elevation of blood pressure in preeclamptic mothers (10,11). The serum magnesium also decreases in women with pre-eclampsia (10).Magnesium has long been recognized as an essential cofactor in a variety of enzyme systems.In addition to changes in serum calcium and magnesium levels, pre-eclampsia causes a rise in uric acid levels. Reduced renal excretion as a result of pre-eclampsia, increased tissue degradation, acidosis, and an increase in the activity of the xanthine oxidase/dehydrogenase enzyme are all proposed mechanisms for the increase in uric acid in pre-eclampsia (12).As a result, preeclampsia could be caused by changes in calcium, magnesium, and uric acid metabolism during pregnancy.It has been documented that preeclampsia can occur in women who have gestational diabetes mellitus (13).The aim of this study was to compare and quantify

serum calcium, uric acid, glucose, and magnesium levels in pre-eclampsia and normal pregnant women, as well as determine whether there was any association between them.

Material and Methods:

After approval from the institutional ethical committee this case control study was conducted in the Department of Biochemistry, in collaboration with the Department of Obstetrics and Gynecology at Sri Aurobindo Medical College & P.G Institute, Indore, Madhya Pradesh. The study lasted a year, from January to December 2015. For the Study, a total of 100 women ranging in age from 18-35 years were recruited. They were divided in two groups. each group consist of 50 subjects.

Inclusion Criteria:

Group-A (Cases): A total of 50 preeclamptic women with a gestational age ≥ 20 weeks are included in the group. The diagnosis of pre-eclampsia was made using the American College of Obstetricians and Gynecologists' defination. (14).

Group-B (Controls): The controls were 50 healthy pregnant women of the same gestational age who had no history of systemic disease and were from the same socioeconomic group. Controls were normotensive and had no proteinuria

Exclusion Criteria:

Patients with kidney disease, liver disease, heart disease, moderate to severe anemia, diabetic, endocrine disorders, twin pregnancies, chronic hypertension, women on medication, or other pre-existing medical conditions affecting study parameters were excluded from the study.

sphygmomanometer was used to measure blood pressure in lying down position. Urine sample was collected on the spot. Blood Samples were collected before commencement of medication. using all aseptic precautions 5 ml of venous blood was collected from all subjects in sterile disposable tubes from medial cubital vein. Blood sample was allowed to clot for few minutes and then subjected to centrifugation for 10 minutes at 3000 rpm. Separated Serum was used for the estimation of calcium, magnesium, uric acid and glucose.

The Arsenazo-III (15) colorimetric method was used to determine serum calcium, the Xylidyl blue (16) colorimetric method was used to determine magnesium, the PAP enzymatic method was used to determine uric acid (Uricase method)(17) and the GOD-POD enzymatic (18) colorimetric method was used to measure fasting blood glucose .

SPSS (Statistical Package for Social Science) version 15 was used for statistical analysis. For assessing the significance of difference between the groups student's t test was used. All results are presented as mean ± S.D. a 'p' value of less than 0.001 was considered significant.

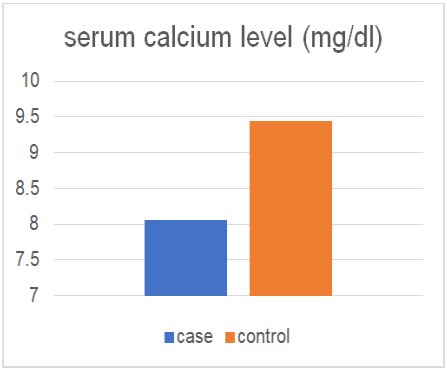
Results:

Table 1: shows the patient's clinical characteristics, age and parity ofcases and controls. cases had a systolic blood pressure of 152.40 ± 4.64 and controls had a systolic blood pressure of 108.82± 2.68 cases had a mean diastolic blood pressure of 106.4±8.56 and controls had a mean diastolic blood pressure of 76.28± 6.62. Microalbuminuria was 308.64±50.44 and 27.62±18.44 in the cases and controls, respectively.

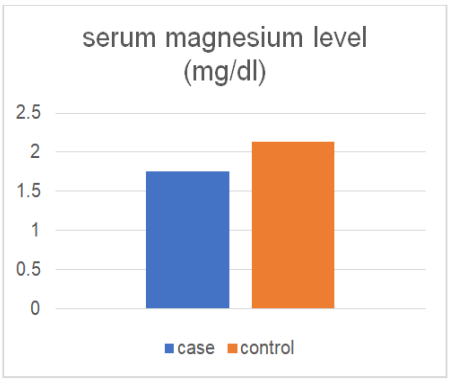
	Group A(cases) n=50	Group B(controls) n=50
Mean age (years)	24.56 ±2.84	23.78±3.22
Gravida Primi Multi	 34(68%) 16(32%)	 30(60%) 20(40%)
Blood pressure (mmHg) Mean systolic pressure Mean diastolic pressure	 152.40 ± 4.64 106.4±8.56	 108.82 ± 2.68 76.28± 6.62.
Microalbuminaria	308.64±50.44	27.62±18.44

Table 2: shows the level of biochemical parameters.The mean serum calcium level in pre-eclampsia was 8.06±0.54 mg/dl, whereas it was9.44±0.82 mg/dl in controls. As compared to normal healthy pregnant women, pre-eclamptic patients have a substantial decrease in mean serum calcium values (p<0.001). The mean serum magnesium level of preclampsia was 1.76±0.24mg/dl which is lesser in comparison to normal pregnant women (2.14±0.17mg/dl). the mean serum uric acid levels in pre-eclamptic women were 6.62±0.84mg/dl, compared to 3.96±0.58mg/dl in the control group. When compared to normal healthy pregnant women, pre-eclamptic cases had a statistically significant rise in mean uric acid levels (p<0.001). in the present study the mean blood glucose level of normal pregnant women (88.74 ± 9.76mg/dl) was lesser in comparison to preclampatic women (98.42 ± 16.50 mg/dl).

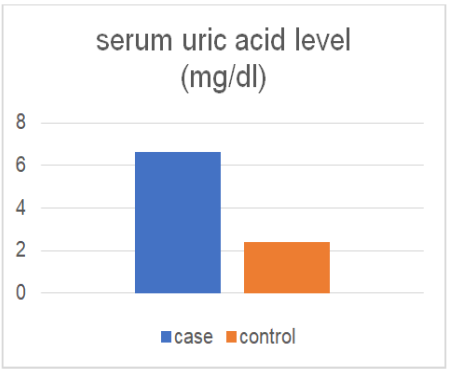
	Group A(cases)	Group B(controls)	P value
Serum Calcium (mg/dl)	8.06±0.54	9.44±0.82	<0.001S
Serum Magnesium (mg/dl)	1.76±0.24	2.14±0.17	<0.001S
Serum Uric acid (mg/dl)	6.62±0.84	3.96±0.58	<0.001S
Serum Glucose (mg/dl)	98.42±16.50	88.74±9.76	



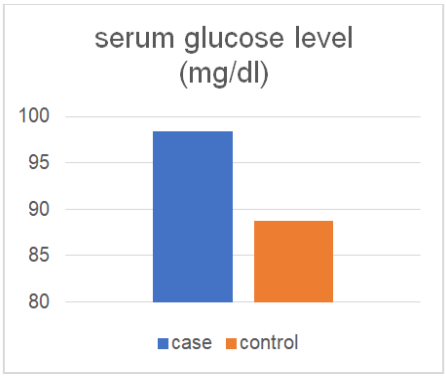
Bar chart No. 1: Showing comparison of mean serum Calcium level between cases & controls.



Bar chart No. 2: Showing comparison of mean serum Magnesium level between cases & controls.



Bar chart No. 3: Showing comparison of mean serum uric acid level between cases & controls.



Bar chart No. 4: Showing comparison of mean serum glucose level between cases & controls.

Discussion:

In present study , the serum calcium level in pre-eclamptic women was significantly lower ($p<0.001$) than in normal pregnant women.Similar findings were obtained byNataraj B et al(19),Garg D K etal (20) , Sandip S et al (21). various other observer have similar observation that preeclampsia patients had a substantial reduction in serum calcium. When serum calcium levels are low, parathyroid hormone level rises, and membrane permeability increases leading to shift of calcium intracellularly this increase vascular smooth muscle contraction leading to raised blood pressure(22).

Compared to healthy pregnant women, serum magnesium levels in preeclampsia patients were significantly lower ($p<0.001$). similar results were obtained by Garg D K et al(20), Sandip et al. (21) and Lambe et al. (23). Reduced extracellular magnesium induces partial membrane depolarization and reduced repolarization, as well as the opening of membrane calcium channels, resulting influx of calcium intracellularly.Low serum magnesium is also said to increase endothelin-1-mediated smooth muscle contraction and inhibit the release of prostacyclin from the endothelial cells of the umbilical arteries, resulting in an increase in blood pressure (24).

Preeclampsia was found to have lower serum calcium and mean serum magnesium levels than normal pregnancy.These results backed up the theory that Hypocalcaemia and Hypomagnesaemia may be etiologies for Preeclampsia.

The levels of serum uric acid in pre-eclamptic women were significantly higher than in normal pregnant women in the present study. similar results was observed byChaganti s et al (25) and Sandip et al (21) Renal dysfunction has resulted in decreased renal urate clearance, which has resulted in an increase in serum uric acid.In endothelial cells, soluble uric acid reduces nitric oxide production. Hyperuricemia can thus lead to endothelial dysfunction.

The mean blood glucose level of normal pregnant women was lower in comparison of preclamptic women. The function of tumour necrosis factor–alpha (TNF–) as a cytokine in blood sugar elevation, especially in preclampsia patients, has been hypothesized (26).

Conclusion:

Based on the findings of this study and evidence from the literature, it is clear that serum levels of calcium, magnesium,uric acid and glucose are altered in pre-eclampsia, implying that these factors may play a role in the aetiology and severity of pre-eclampsia. However, it is unclear if these changes are a cause or a result of the diseased.so assessing the serum level of this parameters will aid in the early detection of pre-eclampsia.

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