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Association of serum calcium and magnesium levels in pre-eclampsia: A case control study

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Abstract
Background: Association of decreased levels of calcium and magnesium with pre-eclampsia has been proposed since decades. However, many studies across the world show variable results. Hence this study was done to establish association of serum calcium and magnesium levels in pre-eclampsia in our population.
Methods: Total of 400 women, 200 pre-eclamptic (study group) and 200 normotensive (control group) pregnant women of similar demographic data were enrolled in the study. Serum calcium and magnesium levels were estimated by spectrophotometry.
Results: In our study the mean serum concentration of calcium in pre-eclampsia group is (8.81 ± 0.79 mg/dl) compared to normal pregnancy (9.86 ± 5.86 mg/dl) (p=0.012). The mean serum calcium concentration in pregnancy induced hypertension patients is decreased as compared to normal pregnancy and this decrease is of statistical significance with p value <0.05. The mean serum magnesium is lower in pre-eclampsia group (1.94 ± 0.24 mEq/L) than normal pregnancy (2.01 ± 0.34 mEq/L) (p=0.017) which is moderately significant.
Conclusion: The serum calcium and serum magnesium levels are significantly decreased in pre-eclampsia patients compared to normotensive pregnant women, suggesting the possible role of calcium and magnesium in etio-patho-physiology of pre-eclampsia. Hence, antenatal screening of high-risk cases, early identification and supplementation of calcium and magnesium to all pregnant women may help reducing incidence of pre-eclampsia.

Keywords: Preeclampsia, calcium, magnesium

Introduction
Pre-eclampsia is second most common cause for maternal mortality. 30% of perinatal deaths are attributed to hypertensive disorders of pregnancy [1]. Incidence is around 5 to 8% of all pregnant women [2].Pregnancy is a period of high calcium demand. Decreased serum calcium, elevated intracellular calcium, increases vascular resistance [3]. Ionised calcium is required in synthesis of nitric oxide and prostacyclin, deficiency leading to oxidative stress.

Magnesium is 4th most abundant ion in the intracellular system. It is involved in more than 300 enzymatic activity and has neuro protective effect [5]. It also acts as calcium channel antagonist [4]. Low magnesium may lead to reduction in cerebral blood flow, cerebral vasospasm, and neuronal burst. This study was undertaken to establish association of S. calcium and S.magnesium levels in pre-eclampsia in our population.

Materials and Methods
400 pregnant women attending antenatal care at VIMS Ballari having more than 20 weeks of gestation who were willing to participate were recruited in the study. Normotensive women were grouped into control group (200). Another 200 women having similar demographic data having singleton pregnancy diagnosed preeclamptic non diabetic were grouped in to study or case group. Chronic hypertension, Gestational diabetes mellitus, Renal disease cases were excluded from both the groups. About 5 ml of venous blood was collected in the morning with fasting state in a clean and dry centrifuge tubes. Blood was allowed to clot; Serum was separated from the clot by centrifugation. Serum calcium and magnesium was measured by spectrophotometry. Levels of serum calcium and serum magnesium in pregnancy induced hypertension and normal pregnancy were evaluated and correlation with preeclampsia was noted.

All the collected data was entered into an excel data sheet. After appropriate data filtration, the data sheet was transferred and analysed using SPSS software version 20.0. Appropriate descriptive statistics like rates, percentages, proportions, mean, and standard deviation were used to describe the data variables. The results were expressed as mean +/-standard deviation. And cases and controls are compared using analysis of variance (ANOVA)

Results

Table 1: Comparison of age distribution in case and Control group

Age (in years)	Cases (No)	Percentage	Controls (No)	Percentage
18-20	74	37%	99	49.5%
21-25	90	45%	67	33.5%
26-30	32	16%	30	15%
30-35	4	2%	4	2%
Total	200	100	200	100
Mean+/-SD	22.78+/-3.35		22+/-3.54	P –0.026

Table 2: Comparison of mean blood pressure, Gestation and BMI in control and case group

	Cases	Controls	P-value
SBP	152.36+/-13.99	113.86+/-7.33	<0.0001
DBP	101.50+/-8.83	72.84+/-5.67	<0.0001
Gestation	38.2+/-2.26	39.14+/-1.24	<0.0001
BMI	25.72+/-3.67	23.79+/-2.9	<0.0001

SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, BMI: Body Mass Index

Table 3: Comparison of mean BMI

BMI	Cases		Controls	
<18.9	2	1%	0	0%
18.9-24.9	90	45%	147	73.5%
25-29.9	85	42.5%	45	22.5%
>30	23	11.5%	8	4%
Total	200	100	200	100
Mean+/-SD	25.72+/-3.67		23.79+/-2.9	P-value<0.0001

Table 4: Comparison of serum calcium and serum magnesium in two groups

	Cases	Controls	P-value
S. Calcium	(8.81 ± 0.79 mg/dl)	(9.86 ± 5.86 mg/dl)	0.012
S. Magnesium	1.94 ± 0.24 mEq/L	2.01 ± 0.34	0.017

Discussion

Preeclampsia along with its complications is one of the major causes of maternal and fetal mortality and morbidity. Association of decreased levels of calcium and magnesium with pre-eclampsia has been proposed since decades. However, many studies across the world shows variable results. Magnesium sulphate is the treatment of choice in prevention of seizures in preeclampsia. It also has beneficial effect on feto maternal perfusion and may influence calcium homeostasis and nonenzymatic antioxidant reserve in erythrocytes of preterm newborns [14]. Magnesium concentration influences calcium metabolism of vascular smooth muscle cells by changing the calcium influx through the plasma membrane. Consequent to hypomagnesaemia, serum calcium also falls which further aggravates the neuromuscular irritability and convulsions. Magnesium sulphate has been used as the drug of choice in severe pre-eclampsia and eclampsia treatment [15].

In an effort to reduce the occurrence of complication in hypertensive disorders in pregnancy establishment of association of hypocalcaemia and hypomagnesaemia may help in prevention.

Age and BMI distribution in both the groups was comparable. Mean serum concentration of calcium in pre-eclampsia group is (8.81 ± 0.79 mg/dl) compared to normal pregnancy (9.86 ± 5.86 mg/dl) (p=0.012). The mean serum magnesium is lower in pre-eclampsia group (1.94 ± 0.24 mEq/L) than normal pregnancy (2.01 ± 0.34 mEq/L) (p=0.017). Both the values are significantly low compare to normal in our study.

This study result was consistent with other study in which mean serum calcium and magnesium is significantly lower in pre-eclampsia group (8.15 ± 0.37 mg/dl) (1.78 ± 0.70 mEq/L) compared to normal pregnancy (9.16 ± 0.82 mg/dl) (2.08 ± 0.46 mEq/L) respectively [16]. In an another study serum calcium (p<0.001) and magnesium (p<0.001) levels were significantly decreased among cases when compared to controls [17]. There was inverse correlation between systolic/diastolic blood pressure with both calcium and magnesium (P<0.01) [18]. But some studies shows contradictory to our studies such as ether was a non-significant differences in serum calcium and serum magnesium levels between cases and controls with p- values of 0.092and 0.972 respectively [19].

Conclusion

The serum calcium and serum magnesium levels are significantly decreased in pre-eclampsia patients compared to normotensive pregnant women, suggesting the possible role of calcium and magnesium in etio patho-physiology of pre-eclampsia. Hence, antenatal screening of high-risk cases, early identification and supplementation of calcium and magnesium to all pregnant women may help reducing incidence\complications of pre-eclampsia.

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