

Serum Calcium, Magnesium and Parathyroid Hormone in Normal Pregnant and Pre-eclamptic Women in Karachi, Pakistan

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Abstract

Objective: The objective of this study was to compare serum calcium, magnesium and Parathyroid hormone in preeclamptic women and normal pregnant females.

Materials and Methods: 32 pregnant women, preeclamptic n=16 and healthy pregnant control group n=16 with same ages and period of gestation included in present study. Serum calcium, Magnesium and Parathyroid Hormone were done by standard methods. Data are presented as mean \pm SEM. P value < 0.01 was considered statistically significant.

Results: Serum calcium (7.02 ± 0.99 vs. 9.34 ± 0.57) and serum magnesium (1.3 ± 0.34 vs. 1.88 ± 0.16) was significantly lower in preeclamptic women than normal healthy controls. PTH (Intact) concentration was not changed as compare to normal control (24.07 ± 4.98 vs. 23.86 ± 3.30).

Conclusion: Decreased levels of serum Calcium and serum Magnesium found in our study confirms there strong relation with preeclampsia. Calcium and magnesium supplement can be used in pregnant women for the prevention of preeclampsia.

Keywords: Preeclampsia; Serum Calcium; Serum Magnesium; Parathyroid Hormone

Introduction

Pre-eclampsia (PE) is the most common life-threatening hypertensive disorder of pregnancy, define as a systemic syndrome characterized by hypertension, proteinuria and edema after 20 weeks of gestation [1-3]. Pathophysiology of PE is still unclear and it becomes apparent at the late stages of pregnancy, usually in the third trimester [1,4]. It is the leading global cause of maternal and perinatal mortality and approximately 50,000 to 60,000 women die each year out of which 9% of maternal deaths in Asia [1,5]. Pre-eclampsia is characterized by malignant hypertension and epileptiform convulsions requiring emergency caesarian section [4]. Mild preeclampsia occurs in approximately 15% of pregnancies, moderate to severe preeclampsia in around 8% and severe preeclampsia in about 1% to 2% [2]. High incidence of pre-eclampsia was shown in Pakistani studies [4,6].

Minerals and micronutrients have important influence on the health of pregnant women and growing fetus [7]. The abnormal of minerals and metal ions plays an important role in health and their deficiency may be associated with hypertension. The factors that contribute in PE include older maternal age, stress, obesity, diabetes, calcium deficiency [8]. Significantly decreased Level of calcium observed in pre-eclampsia [9]. Disturbance in metabolism of essential micronutrients like calcium and magnesium may play an important role in the development of pre-eclampsia [7]. Inadequate intake of calcium plays a contributory role in the pathogenesis of hypertension [10]. High concentration of intact parathyroid hormone is a functional indicator of vitamin D insufficiency and a sign of impaired calcium metabolism which is associated with increased risk of preeclampsia [11].

Magnesium intake plays an important role in magnesium status especially during pregnancy [12]. The hypomagnesaemia increases the risk of pregnancy complications, like pre-eclampsia [7]. Magnesium sulfate is always using to prevent seizures in the pre-eclampsia [5].

In the view of all above findings our present study was designed

to estimate serum Ca, serum Mg and serum PTH levels in the preeclampsia.

Materials and Methods

Thirty-two pregnant women were included in this case control study, which were selected from Obstetrics and Gynae wards of the Holy Family Hospital and Civil Hospital, Karachi, in third trimester of pregnancy. The sample collection duration was from Dec 2003 to Dec 2004. These thirty-two (n=32) subjects were divided into two groups, sixteen (n=16) women represented as study group while sixteen (n=16) women represented the control group.

Selection criteria of study group

- All in third trimester.
- Age between 20-30 years.
- All diagnose to have pre-eclampsia [The term preeclampsia (PE) define as hypertension with blood pressure of 160 mmHg systolic or diastolic blood pressure of 110 mmHg, or greater, arising after 20 weeks of gestation in a woman who was normotensive before 20 weeks gestation, associated with proteinuria] [13].
- All have systolic BP \geq 160 mmHg.

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- All have diastolic BP \geq 110 mmHg.
- No history of diabetes or hypertension
- No history of any Urinary Tract Infection (UTI).
- No history of any other disease.

Selection criteria of control group

All fulfill previously mention criteria but do not develop hypertension during all whole pregnancy. No diabetic or other metabolic disease.

Measurements

Blood pressure of both normal and preeclamptic group was measured by the sphygmomanometer. For diagnosing proteinuria 2 midstream urine samples collected in morning and evening showing albumin \pm in reagent stripe.

All parameters were done with serum by using commercially available kits. The sample was drawn before the onset of labor in third trimester of pregnancy. Peripheral venous blood specimen was collected into glass tubes from all 32 women. After clotting, the samples were centrifuge on 3000 rpm for 15 minutes and serum was separated carefully.

Estimation of Serum Calcium (mg/dl)

Serum Calcium was estimated by o-Cresolphthalein complexone, without deproteinization method. Calcium forms a violet complex with o-Cresolphthalein complexone in an alkaline medium [14].

Estimation of Serum Magnesium (mg/dl)

Serum Magnesium was estimated by Xylidyle blue. Magnesium ions reacts with xylidyl blue in an alkaline medium to form a water soluble purple red chelate, the color intensity of which is proportional to the concentration of magnesium ion in the sample. Calcium is excluded from the reaction by complexing with EGTA [15].

Estimation of Serum Parathyroid Hormone (pg/mL)

Serum PTH was measured by an Immulite intact PTH assay. Immulite Intact PTH is a solid phase, two site chemiluminescent enzyme labbled immunometric assay [16].

Statistical analysis

Mean and standard deviation were calculated for both control and PE groups. Values of all parameters were analyzed using SPSS Version 16t. Data are presented as mean \pm SEM. P value <0.01 was considered statistically significant.

Results

The different clinical parameters like patient's age, gravid, gestational age and blood pressures of both control and study groups are shown in Table 1. Patients ages and gestational ages were not statistically different in both groups. The Table 2 represents the laboratory findings.

Blood pressure

The results of both systolic (166.25 ± 20.62 vs. 113.13 ± 10.78) and diastolic blood pressures (133.75 ± 15.0 vs. 86.88 ± 9.46) were significantly higher in study group as compare to control group as shown in Table 1 ($P<0.01$).

Serum Calcium

The serum calcium concentration in PE women was significantly lower than normal controls (7.02 ± 0.99 vs. 9.34 ± 0.57) as shown in Table 2 ($P<0.01$).

Serum Magnesium

Like serum calcium, serum magnesium concentration in PE women were significantly lower than that in normal controls (1.3 ± 0.34 vs 1.88 ± 0.16) as shown in Table 2 ($P<0.01$).

Serum Parathyroid Hormone

PTH (Intact) concentration was not changed as compare to normal control (24.07 ± 4.98 vs. 23.86 ± 3.30) as shown in Table 2.

Discussion

In the present study we found serum Calcium and serum Magnesium levels in preeclamptic pregnant women are lower than in normal controls also supported by while serum PTH results are not significant as shown in Table 2 [7,17,18].

Our results showed low serum Calcium levels in preeclamptic pregnant women when compare with normal pregnant females. Same found in Korean, Nigerian and Iranian study [19-21].

According to Malas NO and Shurideh ZM during pregnancy due to the increase in glomerular filtration rate, calciuria increases along with removal of more calcium by transfer it to the fetus so maternal calcium levels down [17]. But Pal et al. and some other study results explains that the excretion of calcium was reduced in the third trimester in preeclampsia Calcium requirement increase in pregnancy and this increase reached at peak in third trimester which may cause the hypocalcaemia and due to hypocalcaemia constriction of smooth muscles in blood vessels and increase of vascular resistance occurs and causes changes in blood pressure [18,22-25].

Serum magnesium levels in the preeclamptic women were significantly lower than normal pregnant women in our study also supported by Nigerian and Iranian study [12,26]. Inadequate intake of magnesium, increased metabolic demand of pregnancy and physiological hemodilution in pregnancy were suggested as the main reasons for low levels of magnesium in pregnancy [12].

Decreased levels of serum Calcium and serum Magnesium found in our study showed the strong relation with preeclampsia also supported

Parameters	Control n=16	Pre-eclampsia n=16
Age	25.56 \pm 3.68	24.65 \pm 4.25
Gestational age	32.87 \pm 1.45	32.31 \pm 1.19
Systolic BP	113.13 \pm 10.78	166.25 \pm 20.62
Diastolic BP	86.88 \pm 9.46	133.75 \pm 15.0

Table 1: Clinical Parameters of Normal Controls and Pre-eclamptic Patients.

S #	Investigations	Normal Ranges	Controls Group n=16	Preeclamptic Group n=16
1	Ca	8.10-10.4 mg/dl	9.34 \pm 0.57	7.02 \pm 0.99*
2	Mg	1.70-2.70 mg/dl	1.88 \pm 0.16	1.3 \pm 0.34*
3	PTH (intact)	16-87 pg/mL	23.86 \pm 3.30	24.07 \pm 4.98

* $P<0.01$

Table 2: Calcium, Magnesium and PTH of Normal Controls and Preeclamptic Patients.

by [7,18]. Ca and Mg are very important micronutrients and involves in various cellular mechanisms like muscle contractility. Blood vessels require sufficient amount of calcium to contract and magnesium to relax and open up to regulate the normal blood pressure [7]. Depletion of any of these two nutrients (calcium and magnesium) thus plays an important role in the pathogenesis of PE.

In our results PTH levels of study group were not differ from the control group as shown in Table 2. The difference in calcium metabolism is not related to alterations in the secretion of this hormone also supported by Sanchez-Ramos et al. [27]; it may be due to hypomagnesaemia.

Conclusion

Decreased levels of serum Calcium and serum Magnesium found in our study confirms there strong relation with preeclampsia. Calcium and magnesium supplement can be used in pregnant women for the prevention of preeclampsia. studies with larger sample size require to confirm these results.

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