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# Correlation of Serum Calcium and Serum Magnesium Levels in Antenatal Women with Preeclampsia and Normotensive Antenatal Women

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## ABSTRACT

*Background: One of the hypertension illnesses of pregnancy is pre-eclampsia. It's one of the many causes of mother's and perinatal illness and death Despite ongoing extensive investigation over many years, the cause of this disease still remains difficult to understand, hypertensive disorders throughout pregnancy impact around 10% of all pregnant women globally and according reports. Pre-eclampsia One of the hypertension diseases of pregnancy is pre-eclampsia it is one of many causes of maternal and perinatal disease and death. Preeclampsia affects three to five percent of pregnancies, whereas hypertensive disorders throughout pregnancy impact around ten percent of all pregnant women globally and according reports. Preeclampsia is a multisystem hypertension illness that affects pregnant women. After 20 weeks of pregnancy, it is a disease characterised by widespread vascular endothelial dysfunction and vasospasm. As the exact cause of pre-eclampsia is unknown, no standards of indicator exist and due to lack of randomized controlled trials and the search for an ideal indicator is still on.*

*Methodology: The present tests will be done in the Department of Obstetrics and Gynecology of a tertiary care hospital to correlate the levels of blood plasma magnesium and calcium in antenatal women with preeclampsia and normotensive antenatal ladies from 20-42 weeks of gestation.*

*Results: The results will be analyzed quantitatively and qualitatively using SPSS software.*

*Conclusion: There is very significant correlation amongst the low levels of blood plasma calcium and magnesium levels and pre-eclampsia hence to improve pregnancy outcome supplementation of high dose 2gm calcium and magnesium be made mandatory for all antenatal women in the study.*

**Key words:** Pre-eclampsia, Hypertension in pregnancy, Pregnant ladies, Serum calcium, Serum magnesium

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## INTRODUCTION

### Hypertension in pregnancy is diagnosed as follows

Blood Pressure two times higher than 140/90 mm of Hg on an occasions at least 4 hrs. apart. In chronic hypertensive pregnancy <20 weeks, Hypertensive before Pregnancy BP doesn't return to normal after delivery. Bp doesn't return to normal after delivery result IN chronic hypertension in pregnancy. Pregnancy induced hypertension >20 weeks Patient wasn't hypertensive before pregnancy in pregnancy, BP increases due to placental pathology. turns to normal Chronic hypertension in within 12 weeks of delivery [1].

### Types of PIH (Pregnancy Induced Hypertension)

Gestational Hypertension, Increased blood pressure more than 20 week's blood pressure comes back to normal within a weeks of delivery Proteinuria absent. End organ damage absent. Pre-eclampsia increased blood pressure for more than 20 weeks. Blood Pressure comes back to normal within a weeks of delivery. Proteinuria present end organ damage present. (Proteinuria or/and end organ damage is present).

### Pre-eclampsia

One of the hypertension diseases of pregnancy is pre-eclampsia. It is one of many causes of maternal and perinatal disease and death. Preeclampsia affects 3 to 5 percent of pregnancies, whereas hypertensive disorders throughout pregnancy impact around 10%

of all pregnant women globally and according reports. Preeclampsia is a multisystem hypertension illness that affects pregnant women. After 20 weeks of pregnancy, it is a disease characterised by widespread vascular endothelial dysfunction and vasospasm. Despite ongoing extensive investigation over many years, the aetiology of this disease remains difficult to understand [2]. Pathophysiology behind the development of pre-eclampsia in pregnancy is as follows Normally, Spiral arteries open in intervillous space, Cytotrophoblast (extra villous) replaces lining of spiral artery, Trophoblastic invasion, helps in angiogenesis, Increase in transverse diameter of arteries resulting in conversion of high resistant vessels to low resistant vessels. In Pregnancy Induced hypertension, the trophoblastic invasion is incomplete (vascular remodeling is incomplete). Antigenic factors decreases, Placental growth factor, Vasodilators decreases NO, Anti-angiogenic factor increases SFLT I, S-Endoline, Vasoconstrictor increases Thromboxane A Prostacyclin .Resistant in the vessels remain high due to vasoconstriction volume of blood coming to impervious space decreases, Placental ischemia (placenta is small pale) takes place as the inflammatory mediators are released making capillary endothelium leaky further causing Fluid in third space resulting in edema and leaky capillaries also causes Hem concentration Thrombosis, multi-organ failure etc. Various theories were stipulated for the explanation of preeclampsia Altered vascular remodeling theory, Genetic theory, Altered immune response to paternal gene. In pre-eclampsia, Hem concentration less blood goes into the kidney of mother, brain of mother, fetal blood flow also leading to increased urea and creatinine, convulsions, IUGR and oligohydramnios respectively. most common organ involved in PIH: Kidney, most characteristic Histopathology finding Glomeruloendotheliosis (Table 1) [3].

**Various risk factor for development of pre-eclampsia include**

Previous H/o pre-eclampsia. Past history of chronic hypertension. Family with hypertension chronic kidney disease. Prime gravida. New paternity. Diabetes – Placentomegaly, Syndrome (APLA, metabolic x syndrome). Twin pregnancy. Rh negative pregnancy. Molar pregnancy. Protective factors: Smoking. Prevention includes Given to only those who have identifiable risk factors. Started from a weeks of gestation (not more than 16 weeks) and continued throughout pregnancy. Aspirin 50-150 mg/day Other measures: Exercise. Heparin + aspirin. Calcium supplementation (only if patients calcium level is low). Measures which don't have any proven benefit in PIH: Bed rest. Salt restriction. Anti-oxidants. Fish oil. Heparin alone.

Management of preeclampsia non-specific management anti-hypertensive therapy anti-convulsant therapy. Definitive management Termination of pregnancy. Anti-hypertensive medication. BP persistently > 150/100 mmHg or BP z 160/110 mmHg even once. Oral therapy if BP 150/100 but <160/110 mmHg [4]. IV therapy for BP 160/110 mmHg-Acute hypertensive crisis.

Can be given include Labetalol (Oral IV), Hydralazine, Nifedipine methyl dopa Contraindicated ACE inhibitors, Losartan, Diuretic, Diazoxide, B-Blockers, methyl Dopa not used for anti-hypertensive crisis: Slow onset of action. Mild anti-hypertensive drug methyl Dopa: Safest anti-hypertensive in pregnancy. Diuretics & B-blockers are contraindicated as anti-hypertensive agents in pregnancy but can be used in females for cardiac indication. Management of mild preeclampsia include Non-specific: Anti-hypertensive used if BP if 2 150/100 (persistent)

Magnesium sulfate (MgSO4), DOC for preventing and treating convulsions in a pregnant hypertensive female. Not an anti-epileptic, not an anti-hypertensive drug.

Magnesium sulfate is centrally acting. mechanism of action: Acts on NMDA receptors in brain Blocks them and cause Central vasodilatation and also causing its effect. Changes in the plasma concentration of certain elements can cause changes in blood pressure, leading to pre-eclampsia during pregnancy [5].

Calcium plays a very important role in the regulation of muscle contraction and the intracellular water balance. Many epidemiological studies conducted in non-developed countries have shown a relation between reduced Ca intake and pre-eclampsia. Mg plays a large role for both neurochemical transmission as well as peripheral vasodilation. Mg levels are known to affect cardiac excitability, vascular tone, and contractility greatly. Mg relaxes the vascular musculature. Vasospasm, elevated blood pressure, and increased neuromuscular irritability all seem to be indications of pregnancy-induced hypertension, both of which are symptoms of symptomatic hypertension [6].

**Aim**

To study correlation of serum Ca and serum Mg levels in Antenatal ladies with pre-eclampsia and normotensive Antenatal ladies.

**Table 1: Pre-eclampsia.**

| Pregnancy induced hypertension condition | Time of termination |
|---|---|
| Mild pre-eclampsia | The termination should be done in two hundred and thirty seven weeks is safe |
| Severe pre-eclampsia | Less than thirty seven weeks of termination is done or recommended |
| Impending eclampsia | Immediate termination is recommended in this case as it is very severe condition |
| Eclampsia | Immediate termination is needed in this condition as it is very severe case |
| Help syndrome | Immediate termination is recommended in the case of HELLP SYNDROME |
| Complications include fetal distress | Immediate termination |

## RATIONALE

As the exact aetiology of pre-eclampsia is not known, no standard of indicators exists and due to less in number of RCT the search for an ideal indicator is still ongoing. Some studies show the mean calcium and magnesium level in the serum is significantly lower in Gestational hypertensive group as compared to normal pregnancy.1,2 There's also no marked difference in mean blood plasma Mg and Ca level amounts in normal pregnancy and Pre-eclampsia, according to certain research.3,4 There is paucity of Indian data where a correlation has been done between levels of calcium and magnesium in blood plasma and severity of pre-eclampsia. The present study is planned to correlate calcium and magnesium levels in the blood levels in antenatal pre-eclamptic women and compared with normotensive pregnant women. This will be helpful to know their role in the aetiology and hence avoidance of preeclampsia by calcium and magnesium supplementation in the prenatal period.

### Problem in diagnosis

Unexplained scientific appearance and recurrence, movement of air causes a prime problem within the analysis of mucormycosis. As the disorder usually develops inside the tissues of the head and neck, both lesions of the oral mucosa and postoperative wounds within the capacity portal of infection. Symptoms are regularly vague and frequently lead patients to seek for dental care within the first place. There are not any dependable serologic, PCR-primarily based, or skin-based totally mucormycosis assessments. Clinical manifestations are deceptive and regularly put off accurate diagnosis and implementation of remedy that makes it worse to be expecting. Unfortunately, scientific symptoms and symptoms of the primary levels of ROCM are faulty-sufferers suffer from joint complications and facial pain, fever, numbness, and runny nose. As the infection progresses and different anatomical systems and areas are hastily affected and paresthesia of the facial and trigeminal nerves, paralysis of different cranial nerves, ophthalmic symptoms and meningitis [7]. Diagnosis of mucormycosis using serological strategies or imaging is hard. Sensitivity to radiological exam within the early stages of the sickness is low and histopathological exam of paraffin-embedded tissue samples is still a great indicator in the diagnosis.

### Objectives

To study the correlation between blood plasma Ca level and pre-eclampsia. To study the correlation between blood plasma Mg level and pre-eclampsia. To study correlation between levels of Mg and Ca and severity of pre-eclampsia.

### Research question

Is there any association between blood plasma calcium and blood magnesium levels in preeclamptic and antenatal women?

## METHODOLOGY

### Study design

A Case Control study.

### Study setting

Department of Obstetrics and Gynecology of a tertiary care centre.

### Study population

Antenatal women visiting OPD or inpatients admitted in labor wards of obstetrics and gynecology department where antenatal women with Pre-eclampsia will be the cases and normotensive antenatal women will be the controls.

### Sample size estimation

Sample size is determined by considering serum magnesium levels as main outcome [8].

The formula used for calculation is: i9

$n=(Z\alpha+Z\beta)2 \times \sigma 2$

$(\mu 1-\mu 2)$Where $Z\alpha$ is normal variant value

$Z\beta$ is normal deviate value $\sigma$ is combined SD of 2 groups

$\mu 1-\mu 2$=Difference of two means. $\alpha=0.05$ $\beta=0.2$

The required sample size is 65 in each group. Total sample size is 130.

### Sampling technique

Convenient sampling technique. All consecutive women fulfilling the Inclusion criteria will be included in the study.

### Selection criteria

#### Inclusion criteria

Diagnosed Pre-eclampsia. Singleton pregnancy. Reproductive age group.

#### Exclusion Criteria

Gestational Hypertension. Long standing hypertension. Kidney disease. Cardiac disease. Hydatid form Mole. Diabetes Mellitus.

### Data collection tool

Case record form Study Period: 1st November 2020-October 2022.

### Method of data collection

The current study will be carried at a tertiary care hospital's Department of Obstetrics and Gynecology to assess blood plasma Mg and Ca levels in pre-eclamptic and normotensive pregnant ladies. Institutional Ethics Committee approval will be taken. Written and informed consent will be taken. The samples for the study will be collected from a cohort of 130 antenatal women fulfilling the Inclusion criteria attending OPD and/ admitted in wards [9]. 65 antenatal women with preeclampsia will be the study cases(A), and 65 normotensive antenatal women will be taken as controls(B). A history will be asked, a clinical examination will be done, a general and systemic examination will be performed, and an obstetric examination will be performed on all women

who are pregnant.

Routine antenatal investigations and preeclampsia related investigations which include, uterine artery Doppler, most common -Giant roll over test: when the patient is turned from left lateral position to supine, if the BP raise ≥ 20 mm Hg, it predicts development of PIH in future.

This test is outdated now. Recent Predictors-Increase in level predicts PIH: Anti-angiogenic factors-1SFLT-1, 1s-Endoline. vasoconstrictors-↑ Thromboxane A, 1 Prostacyclin Decrease in level predicts PIH: Angiogenic factors - VEGF, placental GF [10]. Vasodilator. ultrasonography. Blood plasma calcium and magnesium level will be done. Data will be entered in case record form and entered in excel sheet. Confidentiality will be maintained.

**History taking**

Detailed history will be taken as age, address, husband's occupation, socio economic status by Modified Kuppuswamy Scale, duration of marriage, contraception used, menstrual history, obstetric history, duration of pregnancy, age of conception, family history, past history, personal history and relevant medication history will be asked [11]. Specific questions related to Pre-eclampsia and Pre-monitory symptoms and signs such as visual disturbances, headache, epigastric or right upper quadrant pain, decreased urine output, weight gain and pedal edema will be asked.

**Physical examination**

General and systemic examination including obstetric examination will be done. Blood pressure will be measured in sitting position using a sphygmomanometer after making the patient sit for 3 minutes. The elbow will be flexed and kept at the level of the heart. The cuff will be applied one inch above the brachial artery on the arm. The cuff will be quickly inflated and then released back at a rate of 2mm of Hg per second. When the very first sound is heard, then systolic blood pressure will be measured, and the diastolic blood pressure will be measured when the fourth sound is barely audible [12]. Blood pressure will be tested first in placatory method and auscultatory method Also in physical examination Temperature of the patient, Respiratory rate, pulse rate, cyanosis, clubbing, oedema, lymadenopathy, jugular venous pressure will be taken.

**Collection of blood sample**

Sample for routine antenatal investigations and specific to preeclampsia will be sent.

In the Department of Obstetrics and Gynecology, an additional 5ml of collected blood will be obtained in clean and dry clot activating tubes and sent to the institute's Central Pathology Laboratory to be tested for blood calcium and magnesium levels. Blood will be permitted to clot. Centrifugal will separate the serum from the clot [13]. The Arsenao III technique will be used to test serum calcium, and Methylthymol blue spectrophotometry will be used to assess serum magnesium. Values of blood plasma calcium and magnesium in normotensive pregnancy are shown in Table 2.

**Data management and analysis**

Data will be stored in an excel sheet, verified by another person with the help of MS excel Input validation tool. Accuracy and confidentiality will be maintained. The patient information including her name, phone number, will be taken and the data will be verified and entered in own laptop/ computer to keep the data secured. The data will then be reviewed and entered in a backup file, and evaluated periodically. For all tests, a Value of p of 0.05 will be evaluated statistically meaningful. Odds ratio will be calculated. Confidence Interval of 95% will be considered as statistically significant [14].

**Outcome measures**

**Primary outcomes**

Blood plasma Mg and Ca levels in normotensive pregnant ladies and ladies with pre-eclampsia.

**Secondary outcome**

Severity of pre-eclampsia with amount of blood plasma magnesium and calcium.

## EXPECTED RESULTS

The study includes 65 normotensive antenatal women and 65 women with preeclampsia after 20 weeks of gestation till 42 weeks of gestation. Serum calcium and serum magnesium will be studied in both groups. Comparison and correlation will be done of the calcium and magnesium levels in both groups. Desired outcome will be that lowered blood plasma magnesium and calcium concentrations contribute to the development of pre-eclampsia, and the severity of lower levels are associated with severity of preeclampsia. In normotensive pregnant women and women with preeclampsia, there will be a statistically significant difference in calcium and magnesium blood plasma level [15].

## DISCUSSION

Preeclampsia is an enigmatic entity and the exact aetiology is unknown. Also because origin is unclear, management disputes abound, leaving clinicians confused. In addition, as part of the millennium development objectives, the decrease of maternal and perinatal sickness, as well as fatalities related to pre-eclampsia, is a top priority for the worldwide community. In the last 10 years there has

**Table 2: Values of blood plasma calcium and magnesium in normotensive pregnancy.**

| Trimester | 1st | 2nd | 3rd |
|---|---|---|---|
| Total Serum Ca (mg/dl) | 8.8-10.6 | 8.2-9.0 | 8.2-9.7 |
| Serum Mg (mg/dl) | 1.6-2.2 | 1.5-2.2 | 1.1-2.2 |

been increased awareness of indicators like, placental localization, uterine artery Doppler at 11-14 weeks sow in concentrations of magnesium and calcium in blood, in the cells, and in the blood plasma may lead to the development of pre-eclampsia with all thus factors alterations in calcium homeostasis is also observed in pre-eclamptic patients Many research studies shows the mean blood plasma Mg and Ca level is very lower in Pre-eclampsia group as compared to normal pregnant women.

Bangladesh; used to use a photometric test to estimate serum magnesium in 60 pregnant women with pre-eclampsia and 60 pregnant women who were not hypertensive, and found that the difference in blood plasma magnesium between the two groups was considerably bigger (p=0.001). He also checked at blood plasma magnesium levels in pre-eclampsia and eclampsia patients and found a significant difference (p=0.05) between the two groups.

Blood Ca and Mg levels in 40 pre-eclamptic patients and found that pre-eclamptic pregnant women had low plasma Ca and Mg levels as compared to the normally pregnant women. All these results pointed and supported the hypothesis that the hypo-calcemic and hypo-magnesaemia are possible aetiologies of pre-eclampsia.

Previous studies targeted to gather current information on the function of calcium in hypertensive disorders throughout pregnancy for a translational strategy or essential research. This study by them concluded that there is good positive relationship between calcium and hypertensive disorders or any relationship between their severity. Study, because of all the varying results, more data is required to look at the changes in blood plasma, urine, and cellular calcium in women with high blood pressure.

Some studies shows very similarities in blood plasma Ca and Mg level in optimal pregnant women & Pre-eclampsia. Vahid Roodsari et al study was done to contrast blood plasma Ca and Mg levels in 50 pre-eclamptic and 50 normal pregnant women and found that while blood plasma calcium levels were not vastly different, preeclamptic women's blood plasma magnesium levels were 16 percent lower than normal pregnant women [11-13].

## CONCLUSION

As a result, this may validate the idea that magnesium insufficiency plays a factor in preeclampsia pathogenesis, as well as the use of scanning for it in preeclampsia early detection14-15. Art of obstetric care involves improvement of pregnancy outcome in women predisposed to preeclampsia by imparting knowledge regarding starting high 2gm calcium with magnesium in antenatal women.

## REFERENCES

1. Kanagal DV, Rajesh A, Rao K, et al. Levels of serum calcium and magnesium in pre-eclamptic and normal pregnancy: A study from Coastal India. J Clin Diagn Res 2014; 8:OC01.
2. Purohit A, Vyas RK, Sharma ML, et al. Alteration in serum calcium level in preeclampsia compared to normal pregnancy. Int J Clin Biochem Res 2015; 2:242-245.
3. Punthumapol C, Kittichotpanich B. Serum calcium, magnesium and uric acid in preeclampsia and normal pregnancy. Med J Med Assoc Thai 2008; 91:968.
4. Belizan JM, Villar J. The relationship between calcium intake and edema, proteinuria, and hypertension-gestosis: An hypothesis. Am J Clin Nutr 1980; 33:2202-2210.
5. Purohit A, Vyas RK, Sharma ML, et al. Serum magnesium status in preeclampsia. Int J Med Sci Edu 2016; 3:1-8.
6. Kisters K, Barenbrock M, Louwen F, et al. Membrane, intracellular, and plasma magnesium and calcium concentrations in preeclampsia. Am J Hypertens 2000; 13:765-769.
7. Pairu J, Triveni GS, Manohar A. The study of serum calcium and serum magnesium in pregnancy induced hypertension and normal pregnancy. Int J Reprod Contracept Obstet Gynecol 2015; 4:30-35.
8. Tong GM, Rude RK. Magnesium deficiency in critical illness. J Intensive Care Med 2005; 20:3-17.
9. Sontia B, Touyz RM. Role of magnesium in hypertension. Arch Biochem Biophys 2007; 458:33-39.
10. https://www.degruyter.com/document/doi/10.1515/CCLM.1999.151/html
11. Kshirsagar PC, Acharya N, Acharya S, et al. Seizures in pregnancy-a rare case of neurocysticercosis mimicking eclampsia. J Evol Med Dent Sci 2020; 9:1012-1014.
12. Singh K, Acharya N, Acharya S, et al. Latent Chronic Kidney Disease (CKD) manifesting as eclampsia in elderly primigravida. J Evol Med Dent Sci 2020; 9:3596-3598.
13. Singh K, Singhal S, Acharya N, et al. Posterior reversible encephalopathy syndrome presenting as atypical eclampsia and postpartum status epilepticus. Med Sci 2020; 24:1217-1221.
14. Agarwal H, Inamdar A, Inamdar SA, et al. Posterior reversible encephalopathy syndrome in a patient with eclampsia. J Evol Med Dent Sci 2019; 8:3643-3646.
15. Singhal S, Baheti A, Singh K, et al. Cortical blindness in posterior reversible encephalopathy syndrome in postpartum eclampsia. Indian J Medical Spe 2019; 10:229.