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Original Research Article

Serum calcium level as a predictor for pregnancy induced hypertension

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ABSTRACT

Background: Pregnancy induced hypertension is responsible for causing complications among 7-10% of antenatal females. Intracellular calcium concentrations have been involved in the pathogenesis of pregnancy induced hypertension. To assess estimate serum calcium and assess its the predictive value in development of pregnancy-induced hypertension in 12 to 20 weeks of antenatal women and correlate levels of serum Calcium in pregnancy induced hypertension
Methods: A prospective study was conducted in a tertiary care hospital among 400 pregnant females with 12 to 20 weeks of gestation. Blood pressure was measured using sphygmomanometer A detailed family and medical history was taken. Serum calcium levels were measured by the O- cresol phthalein complexone (OCPC) method.
Results: Among 400, majority of normotensive patients i.e., 184 had serum calcium levels<9 mg/dl and 91 had between 9-10 mg/dl. 121 patients with pregnancy induced hypertension had serum calcium<9 mg/dl and 4 patients had between 9-10 mg/dl. Among Maternal complications all the 7 patients with eclampsia and 03 with abruption had serum calcium levels<9mg/dl. 70 patients of pre-eclampsia had serum calcium<9 mg/dl and only 04 had between 9-10 mg/dl. Severe pre-eclampsia was seen in 32 patients with serum calcium<9 mg/dl and 01 with 9-10 mg/dl of serum calcium. Fetal complications in form of iugr was seen in 40 pts with serum calcium<9 mg/dl. 4 patients have still birth had s calcium<9 mg/dl. Results were found to be statistically significant($p<0.05$).
Conclusion: Hypocalcaemia may have a role in causing pregnancy induced hypertension. Thus, intake of calcium supplements helps to reduce its incidence of PIH.

Keywords: Pregnancy induced hypertension, Hypocalcemia

INTRODUCTION

Pregnancy-induced hypertension (PIH) is characterized by elevated blood pressure (≥140/90 mmHg), with or without proteinuria (≥300 mg/24 hours), occurring after 20 weeks of pregnancy and resolving within 12 weeks after delivery.

It can also refer to the new onset of proteinuria (≥300 mg/24 hours) in women with hypertension who did not have proteinuria before 20 weeks of pregnancy research indicates that 5-6% of pregnancies are affected by this condition. Additionally, hypertensive disorders during pregnancy account for about 15% of maternal deaths worldwide, approximately 30,000 deaths annually.[1,2]

Serum calcium levels in the human body are regulated not only by dietary calcium intake but also by factors such as parathyroid hormone levels, vitamin D and sunlight exposure.[3] The calcium requirement for non-pregnant women is 600 mg/day, which increases to 1,200 mg/day during pregnancy.[4] This higher calcium intake is essential for the growth and development of the fetus's bones and teeth and can be fulfilled through increased dietary calcium consumption during pregnancy.[5] Serum calcium levels tend to decrease during the second and third trimesters, mainly due to haemodilution. Lower serum calcium levels during pregnancy may be linked to complications such as pre-eclampsia, low birth weight, preterm delivery and neonatal death.[6,7]

A study investigating the relationship between dietary calcium intake, serum calcium levels and pre-eclampsia found that participants maintained normal serum calcium levels despite having very low calcium intake during pregnancy. This finding may be explained by greater exposure to sunlight, leading to increased vitamin D production. Serum calcium levels are tightly regulated through complex feedback mechanisms involving hormones such as parathyroid hormone and calcitonin, as well as the actions of the bone, kidneys and small intestine.[8,9]

This study aimed to measure serum calcium levels between 12 to 20 weeks of pregnancy and evaluate their predictive value in the development of pregnancy-induced hypertension in antenatal women. Additionally, it sought to correlate maternal and neonatal outcomes with serum calcium levels in cases of pregnancy-induced hypertension.

METHODS

Study design

This hospital-based prospective study was conducted among pregnant females visiting antenatal OPD and admitted to the obstetric ward and labour room of LLRM Medical College, Meerut during labour.

Study period

Study was conducted for a period of 12 months from October 2022 to October 2023.

All antenatal women subjected to detailed history and examination. Routine antenatal investigations was done. The cases were followed up in antenatal clinics, 4 weekly till 28 weeks, fortnightly up to 34 weeks and thereafter weekly till delivery.

Sample size

Sample size is calculated as n=3.84 pq/d2, where p is prevalence (P was taken from a study conducted by Kant et al, where Prevalence (95% CI) of hypocalcaemia was 23.9% among antenatal women)[8], q is 100-p, d is absolute error taken as 5% loss to follow up-10%.

Sample size came out of be 322. So, this is the minimum sample size, but we have taken 400 pregnant women for our study

Inclusion criteria

21 to 35 years old primi/ multigravidae with singleton uncomplicated pregnancy with gestational age of 12 to 20 weeks as determined by last menstrual period or by ultrasound scan. Antenatal women with first trimester blood pressure record suggestive of normal blood pressure and women willing to participate in the study and ready to deliver in this hospital were included in the study.

Exclusion criteria

Antenatal women primigravidae>35 Year, Antenatal women with chronic hypertension, diabetes mellitus, congenital anomalies, multiple gestations, inherited /aquired thrombophilias, IVF conceived pregnancy, severe anaemia, history of gestational hypertension in previous pregnancy were excluded.

A detailed family and medical history of all the pregnant women with gestational age 12-20 weeks were enrolled. Blood pressure was measured using manual device with well applied sphygmomanometer. Blood pressure was measured in both arms and one with higher value was taken as the blood pressure of record. Korotkoff phase V readings were used for diastolic readings. At the same time blood was taken from the ante-cubital vein using a sterile needle and syringe early in the morning after overnight fasting for serum calcium measurement. Blood samples were allowed to clot and then centrifuged at 3000 revolutions per minute for 10 minutes. Serum calcium levels were measured by the O-cresol phthalein complexone (OCPC) method.

RESULTS

The highest proportion of the patients belongs to 26–30-year age group and upper lower socioeconomic status. The highest proportion of the patients i.e., 304 (76.2%) had serum calcium<9.0 mg/dl and rest 96 (23.8%) had 9-10 mg/dl (Table 1).

The highest proportion 279 (69.75%) of the patients had no complications. 70 (17.5%), 32 (8.00%), 07 (1.75%), 04 (1%), 3 (0.75%) each had pre-eclampsia, severe pre-eclampsia, eclampsia, still birth, abruption respectively (Table 2).

Table 3 shows that majority of normotensive patients i.e., 184 had serum calcium levels<9 mg/dl and 91 had between 9-10 mg/dl. 121 patients with pregnancy induced hypertension had serum calcium<9 mg/dl and 04 had between 9-10 mg/dl. Among maternal complications all the 7 patients with eclampsia and 03 with abruption had serum calcium levels<9 mg/dl. 70 patients of pre-eclampsia had serum calcium<9 mg/dl and only 04 had between 9-10 mg/dl. Severe pre-eclampsia was seen in 32 pts with Serum calcium<9 mg/dl and 01 with 9-10 mg/dl of serum calcium.

Fetal complications in form of IUGR was seen in 40 patients with serum calcium<9 mg/dl and 2 had serum calcium levels between 9-10 mg/dl). 04 patients have still birth had serum calcium<9 mg/dl. Statistical analysis shows that p<0.05 which states that the results are statistically significant (Table 3).

Table 1: Distribution of patients according to serum calcium.

S Calcium (mg/l)	No. of patients	%
<9	304	76.2
9-10	96	23.8
>10	00	00

Mean s calcium=8.959mg/l, SD=1.42.

Table 2: Distribution of patients according to complications.

Complications	No. of patients	%
Abruption	03	0.75
Eclampsia	07	1.75
Pre-eclampsia	70	17.5
Severe pre-eclampsia	32	8.00
Still birth	04	1.0
Nil	279	69.75

Table 3: Distribution of patients according to different variables with serum calcium levels.

S. no.	Variables	Serum calcium mg/dl		P value
		<9	**9-10**	
1.	**Blood pressure status of patients**			
	Pregnancy induced hypertension	121	4	<0.000 highly significant
	Normotensive	184	91	
2.	**Maternal complications**			
	Eclampsia	7	0	<0.000 highly significant
	Pre-eclampsia	70	4	
	Abruption	3	0	
	Severe pre-eclampsia	32	1	
	No complications	193	90	
3.	**Fetal complications**			
	IUGR	40	2	<0.01 Significant
	Still birth	4	0	
	Nil	261	93	

DISCUSSION

In the present study the highest proportion of the patients had low serum calcium levels with mean serum calcium levels of 8.6±0.5. Which is in line with the study conducted by Priyanka et al, in 2019 where the mean serum calcium levels in the study group was 8.47±0.208 mg/dl and Kant et al, in 2019 which shows the prevalence of hypocalcaemia was 23.9%.[10,11]

In the present study the majority of subjects had no maternal complications while only 1/4th subjects had maternal complications in the form of pre-eclampsia, severe pre-eclampsia, eclampsia, still birth, abruption. Similar findings were seen in the study conducted by Kumar et al, in 2019 where the 1/4th of patients was suffered from maternal complication in the form of gestational hypertension, pre-eclampsia and eclampsia group.[9] Those with serum calcium levels less than 9 mg/dl maternal complications arise in the form of eclampsia, pre-eclampsia along with abruption, severe pre-eclampsia. Similar findings were observed in the study done by Kumar et al, in 2019 which shows that hypertensive women with higher uric acid and lower calcium had adverse perinatal outcome as compared to controls.[9]

Fetal complications in form of IUGR and still birth were seen in majority of patients with S calcium<9 mg/dl. Statistical analysis shows that p<0.05 which states that the results are statistically significant. Similar findings were observed in the study done by Kant et al, in 2019, showed that when hypocalcaemic group was compared with norm calcaemic group, the prevalence of pre-eclampsia was same in both the groups.[11] This difference was statistically significant.

This study was conducted at a referral center, limiting its generalizability to the broader population. Additionally, dietary patterns were not assessed, leaving the impact of inadequate calcium intake and the potential confounding effects of diet unaccounted for.

CONCLUSION

This study concludes that hypocalcaemia may have a role in aetiology of pre-eclampsia and maternal and perinatal outcome. Pregnancy can easily lead to maternal calcium deficiency in turn causing increase in blood pressure. Thus intake of calcium supplements may help in reduction of incidence of pre-eclampsia especially in a population of a low resource developing country. But our research is small and more extensive research may be needed for correlation between S calcium level and pregnancy induced hypertension. Future research should focus on ensuring calcium supplements maintain serum calcium balance and target women with low serum calcium for personalized PIH prevention.

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REFERENCES

1. Watanabe K, Naruse K, Tanaka K, Metoki H, Suzuki Y. Outline of definition and classification of "pregnancy induced hypertension (PIH)". Hypertension Res in Preg. 2013;1(1):3-4.
2. Song YX, He LP, Ping C. The Relationship between Serum Calcium Level and Risk Factor of Pregnancy-Induced Hypertension: A Meta-Analysis. Clin Exp Obstet Gynecol. 2023;50(3):66.
3. Peacock M. Calcium metabolism in health and disease. Clin J Am Soc Nephrol. 2010;5(1):23-30.
4. Dietary Guidelines for Indians-a Manual. National Institute of Nutrition, India Council of Medical Research. NIN Press, Hyderabad. 2011.

5. Pitkin RM, Gebhardt MP. Serum calcium concentrations in human pregnancy. Am J Obstet Gynecol. 1977;127(7):775-8.
6. Sabour H, Hossein-Nezhad A, Maghbooli Z, Madani F, Mir E, Larijani B. Relationship between pregnancy outcomes and maternal vitamin D and calcium intake: A cross-sectional study. Gynecol Endocrinol. 2006;22(10):585-9.
7. Hofmeyr GJ, Lawrie TA, Atallah AN, Duley L, Torloni MR. Calcium supplementation during pregnancy for preventing hypertensive disorders and related problems. Cochrane Database Syst Rev. 2014;24(6):67-9.
8. Tessema GA, Tekeste A, Ayele TA. Preeclampsia and associated factors among pregnant women attending antenatal care in Dessie referral hospital, Northeast Ethiopia: a hospital-based study. BMC Pregnancy Childbirth. 2015;15:73.
9. Chhabra S, Singh A. Role of calcium in hypertensive disorders of pregnancy current status of research a minireview. J Nutr Disorders Ther. 2017;7:212.
10. Priyanka S, Rajini B. The study of serum calcium in pregnancy induced hypertension and normal pregnancy and its correlation with pregnancy induced hypertension. MedPulse International J of Physiology. 2017;3(3):37-41.
11. Kant S, Haldar P, Gupta A, Lohiya A. Serum calcium level among pregnant women and its association with pre-eclampsia and delivery outcomes: A cross-sectional study from North India. Nepal J Epidemiol. 2019;9(4):795-803.
12. Kumar N, Singh AK. Maternal serum uric acid and calcium as predictors of hypertensive disorder of pregnancy: A case control study. Taiwanese J of Obst and Gynecol. 2019;58(2):244–50.

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