Section: Obstetrics and Gynaecology

Original Research Article

MAGNESIUM LEVELS IN NORMOTENSIVE AND HYPERTENSIVE PATIENTS IN THIRD TRIMESTER OF PREGNANCY: A CASE CONTROL STUDY

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Abstract

Background: Magnesium may be physiologically important in blood pressure regulation whereas changes in magnesium levels could contribute to the patho-etiology of hypertension. The objective is to compare the serum magnesium levels in Normotensive and hypertensive patients in third trimester of pregnancy. **Materials and Methods:** It is a case control study conducted on 50 patients (25 cases and 25 controls) to compare magnesium levels in normotensive and hypertensive patients in third trimester of pregnancy in Obstetrics Department, S. Nijalingappa Medical College and Hanagal Shri Kumareshwara Hospital and Research Centre, Bagalkot. **Result:** Mean serum magnesium level of the cases and controls was 1.60±0.20 and 1.90±0.20 mg/dl with statistically significant difference between two groups showing less serum magnesium level in cases as compared to controls ($p<0.05$). Mean serum magnesium in overweight and obese hypertensives was significantly lowered. **Conclusion:** The Serum magnesium levels in Hypertensive patients in third trimester of pregnancy were significantly lower compared to normotensive patients. This suggests that supplementation of Magnesium may help in prevention of Pre-eclampsia.

INTRODUCTION

Hypertension is the commonest medical disorder during pregnancy. Pre- eclampsia is one of the most common causes of maternal and fetal morbidity and mortality. It is a systemic disease that affects about 5 – 7 % of all pregnancies and is the most common, yet least understood disorder of pregnancy. It is a rapidly progressive condition characterized by high blood pressure, platelet aggregation, swelling of the lower extremities and protein in urine. Sudden weight gain, headaches and changes in vision are important symptoms. Typically, blood pressure elevations and pre-eclampsia occur in the late second trimester or third trimester.[1]

The pathophysiological mechanism is characterized by a failure of the trophoblastic invasion of the spiral arteries which may be associated with an increased vascular resistance of the uterine artery and a decreased perfusion of the placenta. Clinically pre-eclampsia is characterized by persistently elevated blood pressure of greater than 140/90 mmHg, proteinuria and oedema. It may be associated with complications like visual disturbances, oliguria, eclampsia, hemolysis, elevated liver enzymes, thrombocytopenia, pulmonary oedema and fetal growth restriction.[2]

Eclampsia become a common cause of maternal mortality nowadays and it is defined as generalized tonic clonic seizures and/or coma in a pregnancy complicated with hypertension.[3,4] Magnesium plays an valuable role in neurochemical transmission and peripheral vasodilatation.[5] Blood pressure is affected by magnesium level by modulating vascular tone and structure through its effects on myriad biochemical reactions that control vascular contraction/dilation, growth/apoptosis, differentiation and inflammation Additionally, deficiency of this mineral has been previously related to oxidative stress, proinflammatory state, endothelial dysfunction, platelet aggregation, insulin resistance and hyperglycemia.[6]

Thus, magnesium may be physiologically important in blood pressure regulation whereas changes in magnesium levels may contribute etiopathology of hypertension.

Hence the present case control study was carried out to compare the serum magnesium levels in Normotensive and hypertensive patients in third trimester of pregnancy.

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Objective: To compare the serum magnesium levels in Normotensive and hypertensive patients in third trimester of pregnancy.

MATERIALS AND METHODS

It is study conducted on 50 patients (25 cases and 25 controls) to compare magnesium levels in normotensive and hypertensive patients in third trimester of pregnancy in Obstetrics Department, S. Nijalingappa Medical College and Hanagal Shri Kumareshwara Hospital and Research Centre, Bagalkot.

Study design: case control study.

Study group:

Group 1: Normotensive pregnant patients(control)

Group 2: Hypertensive disorders of pregnancy (cases) Study period: January 2019 – June 2020 (one and a half year) Sample size and its calculation:

Sample size estimation done using open epi software version 2.3.1 at 95% confidence level, 80% power of the study. According to the study conducted by: Ephraim et al.: Serum calcium and magnesium levels in women presenting with pre- eclampsia and pregnancy-induced hypertension: a case–control study in the Cape Coast metropolis, Ghana. BMC Pregnancy and Childbirth 2014 14:390.7

Mean +/- SD of Serum Calcium & Serum Magnesium levels in cases (PIH): 0.87+/_ 0.21

Mean +/- SD of Serum Calcium of Magnesium levels in controls: 0.72+/- 0.07 Sample size estimated is 18~/= 25

Sample size: 50 (25 cases and 25 controls)

Formula used: 2[Z α+Zβ]2 62 d2

Method of collection of data:

Inclusion criteria (for control):

- Age-20-30 years.
- Pregnant women in third trimester of pregnancy (28-40 weeks of gestation)
- Normotensive
- Without proteinuria

Exclusion Criteria

1. Pregnant women with chronic hypertension.
2. With any other medical comorbidities.

Inclusion criteria (for cases):

- Age 20-30 years.
- Pregnant women in third trimester of pregnancy (28-40 weeks of gestation).
- Blood pressure >140/90 mmHg with proteinuria (≥"+").

Exclusion Criteria

Pregnant women with chronic hypertension.

Any other medical comorbidities.

Parameters studied and techniques to be employed: Ethical clearance was obtained from the Institute"s Ethics committee (Human studies). Written informed consent (in English and local language) was taken from all study subjects, before enrolment based on the Inclusion /Exclusion criteria already mentioned. Both cases and Controls were matched based on Parity, BMI and Gestational Age. Detailed history including antenatal, obstetric, any medical history was taken. Clinical examination was done. General condition of the patient is noted. Blood pressure of the patient is checked using sphygmomanometer. With a standard sphygmomanometer and stethoscope, the systolic and diastolic blood pressure of all participants were measured in the right upper arm in sitting posture by Auscultatory method.

The first and fifth Korotkoff's phase were recorded as systolic and diastolic blood pressure respectively. The diagnosis of preeclampsia was based on clinical criteria with blood pressure ≥ 140/90mmHg measured on two occasions 6 hours apart with proteinuria ≥1+ dipstick along with edema (NHBPEP Classification).

Anthropometry: The heights of the participants were measured using standard methodology with the help of non-stretchable inch tape. The weights of the participants were measured using a weighing machine and BMI was calculated using Quetlet Index using the formula Wt (kg)/ht (mt).[2]

Urinalysis was done to see for proteinuria. Clean catch midstream random urine sample was obtained from all participants. The urine protein was measured by dipstick method using Dip N Read reagent strip. The results were graded on the scale of 0 to 4+ (0, none; 1+, 30 mg/dl; 2+, 100 mg/dl; 3+, 300 – 1,999 mg/dl; 4+ ≥ 2000 mg/dl).

Blood sample collection and biochemical analysis 4 ml of venous blood sample was taken from each participant from the cubital vein by using dispovan and transferred into vaccum tube. Blood samples were allowed to clot and centrifuged at 3000 rpm for 3–5 minutes within 30 minutes of sample collection. Serum separation: The blood samples were allowed to clot spontaneously at the room temperature. Then the clotted blood was centrifuged at 3,000rpm for 10 minutes. The serum separated was stored at 2 - 8 degrees Celsius until analysis.

The blood drawn was collected and Estimation of Serum Calcium was done by Orthocresolpthale in complex one method. The Normal serum calcium is 8.5-11 mg/dl. Estimation of Serum Magnesium was done by Calmagite method. The Normal serum Magnesium is 1.9 – 2.9 mg/dl.

Statistical analysis: Data was entered in Microsoft excel and later analysed using SPSS software version 19. Percentages and proportions were used for qualitative data. Mean and standard deviations will be used for quantitative data. Chi-square test is applied for assessing association between the various factors. Student t test was applied for quantitative and qualitative data respectively, other appropriate statistical tests were applied for data collected. $p<0.05$ is considered to be statistically significant.

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RESULTS

Mean age of the cases and controls was 24.20 ± 2.70 and 23.70 ± 2.80 years with no statistically significant difference between two groups (p>0.05)
Mean BMI of the cases and controls was 27.80 ± 4.70 and 27.80 ± 4.70 with no statistically significant difference between two groups (p>0.05)
Mean GA weeks of the cases and controls was 35.30 ± 2.80 and 35.40±2.80 weeks with no statistically significant difference between two groups (p>0.05)
Mean SBP of the cases and controls was 159.00 ± 12.70 and 101.00 ± 9.50 mmHg with statistically significant difference between two groups showing higher SBP in cases as compared to controls (p<0.05)
Mean DBP of the cases and controls was 100.40±7.90 and 68.0± 6.50 mmHg with statistically significant difference between two groups showing higher DBP in cases as compared to controls (p<0.05)
Mean serum magnesium level of the cases and controls was 1.60±0.20 and 1.90±0.20 mg/dl with statistically significant difference between two groups showing less serum magnesium level in cases as compared to controls (p<0.05). [Table 1]
We observed no significant difference in the mean age with respect to 20-24 years age group, 25-29 years and more than 29 years between cases and controls (p>0.05) [Table 2].
Mean serum magnesium in overweight cases and controls in 1.57±0.14 and 1.90±0.09 mg/dl with statistically significant difference between two groups (p<0.05) showing reduced levels of magnesium in cases.
Mean serum magnesium in obese grade 1 cases and controls in 1.69±0.23 and 1.94±0.19 mg/dl with statistically significant difference between two groups (p<0.05) showing reduced levels of magnesium in cases. [Table 3]
We compared mean serum magnesium levels in cases and controls with respect to various gestational age and observed that mean serum magnesium level was significantly lower in cases (p<0.05) showing reduced levels of magnesium in cases [Table 4].

Table 1: Comparison of parameters between cases and controls

Contents	Cases (n=25) (mean ± SD)	Controls (n=25) (mean ± SD)	p-value
Age (yrs)	24.20 ± 2.70	23.70 ± 2.80	0.511
BMI (kg/m2)	27.80 ± 4.70	27.80 ± 4.70	0.698
Weeks of gestation (weeks)	35.30 ± 2.80	35.40 ± 2.80	0.887
Systolic BP (mmHg)	159.00 ± 12.70	101.00 ± 9.50	<0.001
Diastolic BP (mmHg)	100.40 ± 7.90	68.00 ± 6.50	<0.001
Serum Magnesium (mg/dl)	1.60 ± 0.20	1.90 ± 0.20	<0.001

Table 2: Comparison of serum magnesium in different age groups between cases and controls

Serum Magnesium (mg/dl)						
	Cases		Controls		Unpaired t test	
Age	Mean	SD	Mean	SD	P value	Significance
20 - 24	1.61	0.13	1.94	0.15	P<0.000	HS
25-29	1.65	0.21	1.88	0.18	P<0.000	HS
> 29	1.5		2			
HS = Highly Sig						

Table 3: Comparison of serum magnesium between cases and controls with respect to BMI

Serum Magnesium (mg/dl)						
BMI	Cases		Controls		Unpaired t test	
	Mean	Std. Deviation	Mean	Std. Deviation	P value	Significance
Under weight	1.50	0	2.10	0	--	--
Normal range	1.67	0.12	1.92	0.23	P<0.02	S
Over weight	1.57	0.14	1.90	0.09	P<0.001	HS
Obese- Class I	1.69	0.23	1.94	0.19	P<0.03	S
Obese Class II	1.60	0	1.80	0	--	--

Table 4: Comparison of serum magnesium between cases and controls with respect to BMI

Serum Magnesium (mg/dl)						
GA	Cases		Controls		Unpaired t test	
	Mean	Std. Deviation	Mean	Std. Deviation	P value	Significance
30-32	1.62	0.18	1.94	0.09	P<0.007	HS
33-34	1.58	0.20	1.88	0.11	P<0.02	S
35-36	1.66	0.09	1.94	0.25	P<0.02	S
37-38	1.65	0.23	1.93	0.18	P<0.02	S
> 38	1.60	0.12	1.90	0.18	P<0.03	S
HS = Highly Sig, S=Sig						

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DISCUSSION

Hypertensive disorders account for 40,000 maternal deaths annually. Due to this, methods to reduce the risk of hypertensive disorders in pregnancy have received considerable attention. Research is focusing on prevention rather than treatment. There is evidence that indicates a role for micronutrients supplementation in preventing some pregnancy disorders. Among these, increasing calcium and magnesium intake can reduce the risk of pregnancy induced hypertensive disorders.

Magnesium plays an important role in peripheral vasodilatation. However, the role of calcium and magnesium in pregnant women are still being discussed. The aim of this study is to measure serum levels of calcium and magnesium in pre-eclamptic pregnancy and to compare with those in normal pregnancy. Magnesium has been known as an essential cofactor for many enzyme systems. It also plays an important role in neurochemical transmission and peripheral vasodilatation. Magnesium promotes vascular muscle relaxation. Magnesium sulfate has been used as the drug of choice in severe pre-eclampsia and eclampsia treatment. The modification of calcium and magnesium metabolism during pregnancy could be a potential cause of pre-eclampsia.

Many women, especially those from disadvantage backgrounds, have intake of magnesium below recommended levels. Magnesium supplementation during pregnancy may be able to reduce fetal growth retardation and pre-eclampsia and increase birth weight.

In the present study there is a significant decrease in the mean serum magnesium concentration in preeclamptic women compared to the normal pregnant women.

The general characteristics of results our study is same as earlier studies is similar to studies by Rajendra Kumar Chaudhari et al (2018) and Deepa V. Kanagal et al (2014).[8,9]

The biomedical prameters of results our study is same as earlier studies is similar to studies by Deepa V. Kanagal et al,[10] (2014) and Rajendra Kumar Chaudhari et al (2018).[8]

Jain et al,[11] conducted a study to analyze and to compare the concentration of Serum magnesium in women with pre-eclampsia and in normal pregnant women. The study was conducted on Fifty clinically diagnosed patients with pre-eclampsia (25 with mild and 25 with severe pre-eclampsia) and 50 normal pregnant controls were enrolled in this study, found a decrease in both serum calcium and magnesium in pre-eclamptic pregnant women as compared to normal pregnant women in their study thus supporting the hypothesis that hypocalcemia and hypomagnesemia are possible aetiologies of pre-eclampsia. In present study also Deepa Kanagal et al,[10] conducted a study on Levels of Magnesium in Pre-eclamptic and Normal Pregnancy: A Study from Coastal India. The blood samples from 60 preeclamptic women and an equal number of controls were analysed for calcium and magnesium levels. The serum calcium concentration was significantly lower in the pre-eclamptic group compared to normotensives which is in agreement with the present study, whereas the levels of serum magnesium showed a marginal difference in both the groups. (1.43± 0.55 mg/dl Vs, 1.57 ± 0.72 mg/dl P 0.257).

Women with a greater BMI in pregnancy are more likely to become hypertensive than those with a lower BMI. In our study, BMI was significantly higher in the hypertensive group compared to the normotensive group ($p < .001$).

Sukonpan and Phupong and Akhtar et al,[12] also found a significantly higher BMI in the hypertensive group. Women with pre-eclampsia were significantly older than normotensives in our study. Some studies have confirmed this whereas other studies show no relation to age and pre-eclampsia. Lamminpaa et al,[13] in a registry-based study in Finland found that women with advanced maternal age exhibited pre-eclampsia (9.4%) than younger women (6.4%).

CONCLUSION

The Serum magnesium levels in Hypertensive patients in third trimester of pregnancy were significantly lower compared to normotensive patients. This suggests that supplementation of Magnesium may help in prevention of Pre-eclampsia.

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