ORIGINAL RESEARCH PAPER

Volume-7 | Issue-2 | February-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MATERNAL SERUM MAGNESIUM LEVELS AND PERINATAL OUTCOMES

Gynecology

Dr Smiti Nanda HOD and Sr Professor, Dept of Obs and Gyne, PGIMS Rohtak

Dr Jagriti Bhardwaj* Junior Resident, Dept of Obs and Gyne, PGIMS, Rohtak *Corresponding Author

Dr Simmi Kharb Sr Professor, Dept of Biochemistry, PGIMS Rohatk

Dr Rupam Thakur Junior Resident, Dept of Obs and Gyne, PGIMS Rohtak

ABSTRACT

Magnesium is a cofactor in more than 300 enzymetic reactions. Maternal magnesium intake is not only associated with pregnancy outcome but also with infant outcomes. Magnesium deficiency is associated with uterine hyper excitability, premature labor and pre eclampsia. Magnesium deficiency can also lead to problems with regulating body temperature in babies, and can result in sudden infant death syndrome (SIDS) and intra uterine growth retardation (IUGR). Out of one hundred two women who delivered, eleven had pregnancy induced hypertension, thirty one babies had low birth weight, twelve had preterm delivery and three babies were born with poor APGAR scores . Maternal serum levels of magnesium were positively associated with decreased incidence of pregnancy induced hypertension and decreased incidence of preterm birth. There was no association between maternal serum levels of magnesium with birth weight of baby and APGAR score.

KEYWORDS

Magnesium, Maternal outcome, Preterm, Pregnancy, Supplementation

INTRODUCTION

Magnesium is primarily found within the cell[1] where it acts as a counter ion for the energy-rich ATP and nuclear acids. It is a cofactor in more than 300 enzymatic reactions. It critically stabilizes enzymes, including many ATP-generating reactions. It also contributes to the regulation of vascular tone, heart rhythm, platelet-activated thrombosis and bone formation.[2]

Maternal serum magnesium levels up to 20 weeks of gestation ranges from 1.5 to 2.2 mg/dl and thereafter from 1.1 to 2.2 mg/dl .[3,4]Maternal magnesium intake is not only associated with pregnancy outcome but also with infant outcomes.Magnesium deficiency is associated with uterine hyper excitability, premature labor and pre eclampsia. Magnesium deficiency can also lead to problems with regulating body temperature in babies, and can result in sudden infant death syndrome (SIDS)[5,6] and intra uterine growth retardation (IUGR). Magnesium is an essential element for fetal well-being and supplementation of magnesium may be of benefit to fetal outcomes. Australian National Clinical Practice Guidelines2010 recommended antenatal magnesium sulphate for fetal neuroprotection.[7]

The status of maternal serum magnesium levels in adverse pregnancy outcomes is not fully clear. Hence the present study was planned to study the association of maternal serum magnesium levels and birth outcomes. The focus was on four major outcomes namely, pregnancy induced hypertension, low birth weight, preterm birth and APGAR score.

MATERIAL AND METHODS

The present prospective study was conducted in the Department of Obstetrics And Gynecology in collaboration with Department of Biochemistry, Pt. B.D. Sharma, PGIMS, Rohtak.

The study was conducted in 102 pregnant women aged 17 to 36 years attending OPD before 20 weeks of gestation. These women were followed till delivery. An informed and written consent was obtained from all the women

Women with medical disorders such as hypertension, diabetes mellitus, epilepsy, hyperthyroidism, hypothyroidism, severe anemia, malabsorption syndromes, osteomalacia and fluorosis were excluded from the study. Calcium and iron supplementation was given to all the pregnant women with period of gestation more than 20 weeks. Supplementation of 1000mg calcium and 100 micrograms of elemental iron was asked to be taken daily.

Three ml of maternal venous blood was drawn into red vacutainer tubes twice: once before 20 weeks during visit in OPD and second within one hour of childbirth. The blood samples were centrifuged at 3000 rpm for 10 minutes and the serum was analyzed for magnesium. Serum magnesium levels were estimated by using spectrophotometric method.[91]

SPSS ver. 23 was used for statistical analysis. Results were expressed as mean SD and unpaired't' test and Pearson correlation test was applied. Data was considered to be significant if $p < 0.05$.

RESULTS

Out of one hundred two women who delivered, eleven had pregnancy induced hypertension, thirty one babies had low birth weight, twelve had preterm delivery and three babies were born with poor APGAR scores.

TABLE 1: SERUM MAGNESIUM LEVELS AT <20 WEEKS PERIOD OF GESTATION

Serum magnesium at <20 weeks (mg/dL)	Frequency	Percentage
<1.5	5	4.9%
1.5 - 2.2	74	72.5%
>2.2	23	22.5%
Total	102	100%

At <20 weeks of gestation, 74 (72.5%) women had serum magnesium levels between 1.5-2.2mg/dl(mean = 1.8 + 0.1 mg/dl) while 23 (22.5%) had serum magnesium levels >2.2mg/dl(mean = 2.4 + 0.1 mg/dl) and 5 (4.9%) had serum magnesium levels <1.5mg/dl (mean = 1.3 + 0.1 mg/dl).(Table 1)

TABLE 2: SERUM MAGNESIUM LEVELS AT TERM

Serum magnesium at term (mg/dL)	Frequency	Percentage
<1.1	2	2.0%
1.1 - 2.2	83	81.4%
>2.2	17	16.7%
Total	102	100%

At term, 83 (81.4%) women had serum magnesium between 1.1 – 2.2mg/dL (mean = 1.6 + 0.1 mg/dL) while 17 (16.7%) had serum magnesium>2.2mg/dL (mean = 2.4 + 0.1 mg/dL) and 2 (2.0%) had serum magnesium<1.1mg/dL (mean = 1.0 + 0.1 mg/dL).(Table 2)

TABLE 3: COMPARISON BETWEEN SERUM MAGNESIUM LEVELS AT <20 WEEKS AND AT TERM

Serum magnesium at <20 weeks (mg/dL)		Serum magnesium at term (mg/dL)			Total	p value
		<1.1	1.1 - 2.2	>2.2		
<1.5	N	2	3	0	5	<0.001
	%	40%	60%	0%	100%	
1.5 - 2.2	N	0	71	3	74	
	%	0%	96%	4%	100%	
>2.2	N	0	9	14	23	
	%	0%	39%	61%	100%	
Total	N	2	83	17	102	
	%	2%	81%	17%	100%	

There was a positive correlation between the serum magnesium levels at <20 weeks and at term which was statistically significant (p <0.001).(Table 3)

TABLE 4: CORRELATIONS BETWEEN MATERNAL SERUM MAGNESIUM LEVELS AND PREGNANCY INDUCED HYPERTENSION, GESTATIONAL AGE AT DELIVERY, BABY WEIGHT AND APGAR SCORE

	Serum magnesium at <20 weeks		Serum magnesium at term	
	Correlation coefficient	p value	Correlation coefficient	p value
Pregnancy induced hypertension	-0.205	0.039	-0.219	0.027
Gestational age at delivery	0.274	0.005	0.409	<0.001
Baby weight	-0.089	0.374	-0.028	0.783
Apgar score at 1 minute	0.042	0.678	0.071	0.477
Apgar score at 5 minute	-0.055	0.581	-0.054	0.588

The correlation between serum magnesium at <20 weeks with pregnancy induced hypertension was negative and statistically significant (r = -0.205, p =0.039;Table 4). The correlation between serum magnesium at term with pregnancy induced hypertension was negative and statistically significant (r = -0.219, p =0.027; (Table 4).

The correlation between serum magnesium at <20 weeks with gestational age at delivery was positive and statistically significant (r = 0.275,p =0.005;Table 4). The correlation between serum magnesium at term with gestational age at delivery was positive and statistically significant (r =0.409, p< 0.001; Table 4)

Correlations were statistically insignificant between maternal serum magnesium levels with baby weight and APGAR score.(Table 4)

DISCUSSION

Magnesium is important in energy requiring metabolic processes, protein synthesis, membrane integrity, nervous tissue conduction, neuromuscular excitability, muscle contraction, hormone secretion and intermediate metabolism. The normal plasma magnesium concentration is 1.5-2.3 mg/dL.[8]

In the present study, out of one hundred and two women, at less than 20 week period of gestation, seventy four (72.5%) women had serum magnesium levels between 1.5-2.2mg/dL (mean = 1.8 $\pm$ 0.1 mg/dL) while twenty three (22.5%) had serum magnesium levels more than 2.2mg/dL(mean = 2.4 $\pm$ 0.1 mg/dL) and five (4.9%) had serum magnesium levels less than 1.5mg/dL (mean = 1.3 $\pm$ 0.1 mg/dL). At term, eighty three (81.4%) women had serum magnesium levels between 1.1 – 2.2mg/dL (mean = 1.6 $\pm$ 0.1 mg/dL) while seventeen (16.7%) had serum magnesium levels more than 2.2mg/dL (mean = 2.4 $\pm$ 0.1 mg/dL) and two (2.0%) had serum magnesium levels less than 1.1mg/dL (mean = 1.0 $\pm$ 0.1 mg/dL).

Women with high serum magnesium values at less than 20 weeks of gestation had higher values at term and those with lower values at less than 20 weeks of gestation had lower values at term. (Table 1,2,3).

Magnesium deficiency may cause uterine hyperexcitability and give rise to preterm birth. Magnesium supplementation constitutes tocolytic treatment, which is devoid of toxicity and enhances efficacy and safety of other tocolytic drugs such as beta-2 mimetics.

Spätling et al studied the effect of magnesium supplementation in pregnancy. Magnesium supplementation during pregnancy was associated with significant reduction in preterm delivery.[9]

The correlation between serum magnesium levels at less than 20 weeks with gestational age at delivery was positive and statistically significant (r = 0.275, p = 0.005). The correlation between serum magnesium at term with gestational age at delivery was positive and statistically significant (r = 0.409, p < 0.001). The findings of present study are in agreement with the previous studies.

Jafrin et al in a study reported that the mean serum magnesium of pregnant women with pregnancy induced hypertension was significantly decreased in comparison to that of the control. The mean serum levels of magnesium in normal pregnant group was 1.91± 0.08mg/dL, and in the group with pregnancy induced hypertension was 1.75± 0.10mg/dL, indicating that reduction in serum levels of magnesium during pregnancy might be a possible contributor in the etiology of pregnancy induced hypertension and magnesium supplementation as diet or drugs may be of value to prevent pregnancy induced hypertension.[10]

In the present study, magnesium supplementation was not given to pregnant women. However, the observed changes in magnesium values are in agreement with the previous studies. The correlation between maternal serum magnesium and pregnancy induced hypertension was negative and statistically significant (r = -0.219, p =0.027; Table 4).

Elizabeth et al in their study reported that low maternal serum magnesium levels were associated with low birth weight and poor APGAR scores. This discrepancy in results could be attributed to larger sample size in their study (500 newborns).[11]

In the present study, there was no significant correlation between maternal serum magnesium levels and birth weight (r = 0.028, p = 0.783). Also the correlation of serum magnesium levels with APGAR score was statistically insignificant (r= -0.054, p=0.588; Table 4).

CONCLUSION

Maternal serum levels of magnesium were positively associated with decreased incidence of pregnancy induced hypertension and decreased incidence of preterm birth. There was no association between maternal serum levels of magnesium with birth weight of baby and APGAR score.

REFERENCE

1. Elin RJ. Magnesium metabolism in health and disease. Dis Mon. 1988;34:161–218.
2. Swaminathan R. Magnesium metabolism and its disorders. ClinBiochem Rev. 2003;24:47–66.
3. Venkateswarlu P. Evaluation of analytical method for fluorine in biological and related materials. J Dent Res. 1990; 69: 514–21.
4. Leary NO, Pembroke A, Duggan PF, Single stable reagent for optically robust measurement of calcium and magnesium in serum and plasma. ClinChem 1992;38:904-8.
5. Sibai B, Villar M, Bray E. Magnesium supplementation during pregnancy: A double blind randomized controlled clinical trial. Am J Obstet Gynecol. 1989;161:115-9.
6. Stoll B, Chapman I, Kliengman R, Behrman R, Jensen H, Stanton B et al. The high risk infant. In: Nelson textbook of pediatrics. 2007;18:698-711.
7. Melanie B, StLex D, Victoria, William E, Nanaimo B, Robert G et al. Magnesium Sulphate for Fetal Neuroprotection. Am J Obstet Gynecol. 2011;258:516-7.
8. Rigo J, Crurtis M, Martin R, Fanaroff A, Walsh M. Disorders of calcium, phosphorous and magnesium metabolism. Fanaroff and martins neonatal. Perinatal Med Rev. 2006;8:1491-523.
9. Spatling LU, Spatling GA. Magnesium supplementation in pregnancy. A double-blind study. Br J ObstetGynaecol. 1988;95(2):120–5.
10. Jafrin W, Mia AR, Chakraborty PK, Hoque MR, Paul UK, Shaha KR et al. An evaluation of serum magnesium status in pre-eclampsia compared to the normal pregnancy. Mymensingh Med J. 2014;23(4):649–53.
11. Elizabeth KE1, Krishnan V, Vijayakumar T. Umbilical cord blood nutrients in low birth weight babies in relation to birth weight & gestational age. Ind J Med Res. 2008;128(2):128-33.