

SERUM MAGNESIUM STATUS IN PREECLAMPSIA

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ABSTRACT:

Objective: To compare the level of total serum Magnesium (Mg) of pregnant women with preeclampsia with normal pregnant females.

Study design: This was a case control study which included 50 women with preeclampsia in their third trimester of pregnancy as Study group and 50 healthy pregnant women in the third trimester of pregnancy as control group, with similar maternal and gestational age. The concentration of total serum magnesium was measured by Atomic Absorption Spectroscopy. The data was analyzed using Students' t-test wherever applicable.

Result: The total serum magnesium level in preeclamptic women was significantly lower ($p < 0.001$) than in pregnant women of similar maternal and gestational age.

Conclusion: Hypomagnesemia related to preeclampsia supports the hypothesis that alteration in the total serum magnesium levels may be involved in possible etiologies of preeclampsia.

Keywords: - Preeclampsia, Magnesium, Hypomagnesemia, Hypertension, Atomic Absorption Spectrophotometry.

INTRODUCTION:

Hypertensive disorders complicating pregnancy are common and form one of the great triad, along with haemorrhage and infection, which continues to be responsible for a large number of maternal deaths.¹ Pre-eclampsia is a progressive, multisystemic disorder characterized by triad of high blood pressure to the extent of 140/90 mm Hg or more, edema and

proteinuria, developing after 20 weeks of pregnancy.² It is one of the most common complications during pregnancy and the leading cause of both maternal and perinatal morbidity and mortality worldwide.³ Incidence of pre-eclampsia worldwide is around 5-10% of all pregnancies,⁴ and in developing countries around 4-18%.^{5, 6, 7} It is much more common in women

who are pregnant for the first time,⁸ and its frequency drops significantly in second pregnancies. Despite active research for many years, the etiology of this disorder remains unknown, although contributory factors including obesity, diabetes, magnesium deficiency, older maternal age and job stress have been observed and studied.^{9, 10, 11}

The pathophysiological mechanism of preeclampsia in pregnancy is characterized by failure of the trophoblastic invasion of the spiral arteries, leading to maladaptation of maternal spiral arterioles, which may be associated with an increased vascular resistance of the uterine artery and a decreased perfusion of the placenta.⁴ The results from many clinical studies show the relationship between the aggravation of the hypertension complication and the change in concentration of various chemicals in mother's serum.^{12, 13} Some studies have shown that changes in the levels of blood trace elements in preeclamptic patients may implicate its pathogenesis^{14, 15} while others have failed to show an association of blood levels of trace elements and prevalence of preeclampsia.¹⁶ Modification of plasma concentration of some elements may lead to the alteration of blood pressure causing preeclampsia during pregnancy.¹⁷

Magnesium plays an important role in neurochemical transmission and peripheral vasodilatation.¹⁸ Magnesium may influence blood pressure 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.¹⁹ Thus magnesium may be physiologically important in blood pressure regulation whereas changes in magnesium levels could contribute to the pathoetiology of hypertension.²⁰

The present study was done to evaluate the levels of serum Mg in preeclamptic women with the aim of providing preliminary data that could be useful in management of preeclampsia.

MATERIALS AND METHODS:-

The study included 100 pregnant women between 20-35 years of age, attending Gynaecology OPD/admitted in Gynaecology wards in PBM Hospital, affiliated to Sardar Patel Medical College, Bikaner during 2012. 50 clinically diagnosed women with preeclampsia in their third trimester of pregnancy represented as study group.

Inclusion criteria for the study was; females with singleton pregnancy, all in the third trimester which were diagnosed to have PIH based on the development of hypertension for the first time, proteinuria with or without edema, with no history of previous urinary tract troubles and no evidence of UTI. 50 women with normal pregnancy with similar maternal and gestational ages represented as Control group. All were in the same previously mentioned criteria but didn't develop hypertension.

Pregnant ladies with medical complications such as renal disease, trophoblastic disease, heart disease, chronic hypertension and on magnesium sulphate drugs were excluded from study.

Thorough clinical examination was carried out before recruiting the participants for the study by a competent gynecologist. Personal and clinical information regarding age, gestational age, socioeconomic status, education, dietary habit, clinical and biochemical parameters were recorded with the help of a questionnaire, with prior consent of the participant.

Sample collection and estimation of serum magnesium: - 5 ml blood was drawn from antecubital vein in a sterile syringe and was transferred to a clean dry vial slowly by the side of the vial after removing the needle to avoid hemolysis. The blood was allowed to clot at room temperature for 30 minutes and serum was separated by centrifugation at 3000 rpm for 10 minutes.

Serum magnesium was estimated by atomic absorption spectrophotometer (AA-7000) by the method described by Fernandez et al (1971)²¹, in the Department of Biochemistry, S.P. Medical College, Bikaner. For the determination of magnesium, the serum was diluted 1:50 with 0.1% (w/v) lanthanum (as chloride) diluent. The dilution ratio was adjusted to insure that concentration falls within a suitable absorbance range. To analyze the data, Students' t-test was employed wherever applicable to assess the significance of difference among control and study subjects.

RESULTS:-

The total study population included 100 subjects, of which 50 each represented the Control and Study group. The mean of age, socioeconomic status, BMI, gestational age in the two groups did not show any significant difference ($p > 0.4$) so, all such factors were ruled

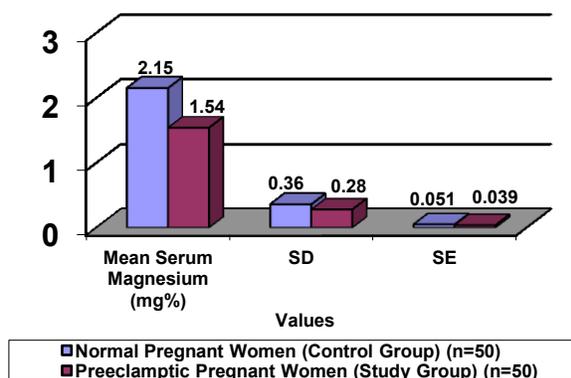
out to have any effect which may influence the serum magnesium levels.

Table-1 Levels of Serum Magnesium in Healthy Pregnant Women (Control Group) and Preeclamptic Pregnant Women (Study Group)

	Control Group (n=50)	Study Group (n=50)
Mean (mg/dl)	2.15	1.54
Range (mg/dl)	1.32 – 3.00	1.01 – 2.16
SD	0.36	0.28
SE	0.051	0.039
DF	98	
t-value	9.15	
p-value	<0.001**	

**Highly Significant

Fig 1. Comparison of mean serum Magnesium levels in Healthy Pregnant Women (Control Group) and Preeclamptic Pregnant Women (Study Group)



The mean serum magnesium level was found to be 2.15 ± 0.36 mg/dl with a range of 1.32 to 3.00 mg/dl in control subjects (Table-1) and 1.54 ± 0.28 mg/dl

with a range of 1.01 to 2.16 mg/dl in preeclamptic pregnant women. There was a significant decrease ($p < 0.001$) in the total serum magnesium levels in study group. These results are in close agreement with findings in conditions of PIH and magnesium deficiency^{22, 23}.

DISCUSSION: -

The study showed that the mean serum magnesium levels decreased in preeclamptic pregnant female group which was statistically significant ($p < 0.001$) (Fig. 1). This result is in concordance with previous epidemiological studies that suggest an inverse relationship between serum magnesium and incidences of preeclampsia.^{24, 25} However, the variations of the studied population and dietary intake at different areas may be responsible for some studies contradictory to the present.^{17, 26}

During pregnancy, hemodilution effect of oestrogen and increased demand of fetus decrease the serum magnesium level and in preeclampsia, urinary excretion of magnesium also increases. So, Hypomagnesemia is associated with hemodilution, altered renal clearance and consumption of minerals by growing foetus.¹⁸

Magnesium has been shown to improve endothelial function in preeclampsia. This may be due to the direct vasodilatory properties of magnesium and/or to the ability of magnesium to stimulate release of endothelial vasodilator prostacyclin, which induces vasodilation as well as inhibits platelet adherence and aggregation.²⁷

In vascular smooth muscle cells, magnesium acts extracellularly by inhibiting transmembrane calcium transport and calcium entry and decreasing contractile actions of

vasoactive agents or intracellularly as a calcium antagonist thereby modulating the vasoconstrictor actions of increased calcium. So, it might be possible that reduced magnesium level would increase the intracellular calcium levels and causes vasoconstriction.²⁰

Therapeutic magnesium sulphate which is used in PIH inhibits Phosphatidyl inositol-4,5-bisphosphate specific phospholipase C activity and subsequent calcium release in the cells, thus leading to decreased intracellular calcium levels and a decrease in blood pressure.²⁸

Unavailability of this element due to deficiency or decreased concentration may be a predisposing factor in the development of preeclampsia or a contributory factor in its pathogenesis. The limitation of this study was that the dietary intake of magnesium was not taken into consideration.

CONCLUSION:-

The result of the present study suggests that hypomagnesemia is present in preeclamptic pregnant women and serum magnesium was significantly lower than in normal pregnant women.

In the light of reduction in the concentration of magnesium, adequate dietary supplementation should be given above the recommended dietary allowances in pregnancy at least in susceptible pregnant women, especially in developing countries. The results may be significant in understanding the possible contribution of serum magnesium in the pathophysiological process of preeclampsia and may help in developing the strategies for prevention and early diagnosis. However, large

multicentric study would throw better light into this matter.

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