ORIGINAL RESEARCH PAPER

Gynaecology

COMPARATIVE STUDY OF SERUM MAGNESIUM LEVELS IN TOXAEMIA OF PREGNANCY AND NORMAL PREGNANCY IN A TERTIARY CARE HOSPITAL

KEY WORDS: Magnesium, pregnancy, toxemia, pre-eclampsia

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ABSTRACT

Magnesium , a miracle mineral has a healing effect on a wide range of diseases. It is essential for many enzyme reactions especially in regard to cellular energy production for the health of brain and nervous system and also for healthy teeth and bones. It is the most important mineral for maintaining proper electrical balance and facilitating smooth metabolism in cells and has a membrane stabilizing effect. **AIMS AND OBJECTIVES :**1.To determine the level of serum magnesium in non-pregnant women of child-bearing age .2. To determine the level of serum magnesium in toxaemias of pregnancy like pre-eclampsia and eclampsia.3.To compare serum magnesium levels of non-pregnant women and normal pregnant women in their third trimester with the serum magnesium levels of patients with pre-eclampsia and eclampsia. 4.To compare serum magnesium levels of pre-eclamptics and eclamptics. **MATERIAL AND METHODS :** Study was carried out in the Deptt. Of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna during September 2006 to September 2008. Estimated by colorimetric method using "Titan Yellow" **Result & Discussion :** The co-existence of toxaemic conditions of pregnancy, further reduces the serum magnesium level in comparison to non-pregnant and uncomplicated pregnancies. Further serum magnesium levels were significantly lower in patients with eclampsia when compared with the serum magnesium levels of pre-eclamptic patients.

INTRODUCTION :

Magnesium is nothing short of a miracle mineral in its healing effect on a wide range of diseases as well as on the ability to rejuvenate the ageing body. It is essential for many enzyme reactions especially in regard to cellular energy production for the health of brain and nervous system and also for healthy teeth and bones. It is the second most abundant mineral in the cells after potassium. The two ounces or so found in the typical human body is present not as metal but as magnesium ion.It is an essential transmembrane and intracellular modulator of cellular activity8. The body works very hard to keep blood magnesium levels constant. Magnesium is the single most important mineral for maintaining proper electrical balance and facilitating smooth metabolism in cells One of the major properties of Magnesium is that of membrane stabilizing,an effect not only for cells but also for various subcellular organelles. In the nucleus more than half the Magnesium is closely associated with nucleic acids and mononucleotides. The enzyme reaction responsible for creation of energy by activating ATP is Magnesium-dependent. The formation of energy rich bonds that require Magnesium constitutes the necessary basis for all cellular activities. Magnesium is essential in regulating central nervous system excitability, thus its deficiency may cause aggressive behaviour, depression or suicide .Magnesium has a graded effect on central and peripheral nervous system. In adequate doses it acts as CNS deterrant. Toxaemia of pregnancy remains an enigma despite many significant advances made. It is a common complication of gestation and continues to be responsible for maternal mortality and perinatal morbidity and mortality. The incidence of this disease has considerably declined as the nutritional, educational and socio-economic status of the population has risen.

Pre-eclamptic and Eclamptic toxaemias of pregnancy are associated with low levels of serum magnesium ,and magnesium is widely used in their treatment. The clinical features of Magnesium deficiency are predominantly neuromuscular with tremors, choreiform movements and aimless picking of clothes. Hyperemia, vasodilation and trophic changes in skin are initial manifestations. Mental depression, confusion, epileptiform convulsion and hyperirritability also occur. Other non-specific symptoms include apathy, positive Chovstek's sign, cardiac arrhythmias7. The diagnosis of low Magnesium level can be confirmed by finding the plasma the plasma magnesium level to be <1.21 mg/100ml.

In view of the above studies carried out earlier, the present study was undertaken to observe serum Magnesium level in normal pregnant women in different trimesters of pregnancy and in toxaemia of pregnancy of varying degree to understand and analyze the effect of Magnesium during pregnancy. For correlation serum Magnesium level in non-pregnant women were also observed. Such a study may definitely prove to be of immense value to our women folk.

AIMS AND OBJECTIVES :

1. To determine the level of serum magnesium in non-pregnant women of child-bearing age .

2. To determine the level of serum magnesium in toxaemias of pregnancy like pre-eclampsia and eclampsia.

3. To compare serum magnesium levels of non-pregnant women and normal pregnant women in their third trimester with the serum magnesium levels of patients with pre-eclampsia and eclampsia.

4. To compare serum magnesium levels of pre-eclamptics and eclamptics.

MATERIAL AND METHODS :

Study was carried out in the Deptt. Of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna during September 2006 to September 2008.

Criteria for diagnosis of Gestational Hypertension :-
1.Blood Pressure :SBP >140 mm of Hg and DBP >90 mm of Hg.
2.Proteinuria : >0.3 gm/L in 24-hrs sample.
3.Pitting oedema of at least +1.
4.Weight gain of >= 5 lbs/mth.
5.History of convulsions and fits to diagnose Eclampsia.

Clinical Procedure :-

A detailed history taking, clinical examination and routine investigations of each case was done.

Specific Biochemical Examination are:

- Serum Total protein , Albumin , and Globulin
- Serum uric acid
- Serum magnesium level
- Serum Random blood glucose level

Determination of Serum Magnesium Level : Estimated by colorimetric method using "Titan Yellow" as described by Neil and Neely (1956).

Calculation : Magnesium per 100 ml serum = T – B / S – B *25 (T=Test, B=Blank, S=Standard)
Selection of cases:- A total of 78 cases were studied.

1. CONTROL GROUP: This comprised of 30 patients who were clinically normal and not pregnant but in the child-bearing age.

2. STUDY GROUP: Pregnant women with Gestational Hypertension.

Distribution of cases	No. of Subjects
1. CONTROL GROUP	30
2. STUDY GROUP	
TOXAEMIA OF PREGNANCY:-(Total)	48
a. Pre-eclampsia	8
Eclampsia	40

Table 1: SERUM MAGNESIUM LEVEL IN STUDY GROUP NORMAL PREGNANCY:DIFFERENT TRIMESTERS ; PRE-ECLAMPSIA AND ECLAMPSIA

GROUPS	NO. OF CASES	SERUM MAGNESIUM LEVEL IN mEq/L		
		RANGE	MEAN	S.D
NON-PREGNANT (CONTROL)	30	1.8 - 2.7	2.21	0.28
1ST TRIMESTER	26	1.8 - 2.3	2.07	0.16
2ND TRIMESTER	21	1.5 - 2.2	1.94	0.21
3RD TRIMESTER	25	1.5 – 2.1	1.79	0.21
PRE-ECLAMPSIA	8	1.2 - 1.8	1.54	0.21
ECLAMPSIA	40	0.5 – 1.2	0.88	0.20

Table 2: SERUM MAGNESIUM LEVELS IN PRE-ECLAMPSIA , ECLAMPSIA AND NON-PREGNANT(CONTROL) GROUPS : COMPARATIVE STUDY

GROUPS	SERUM MAGNESIUM LEVEL IN mEq/L			
	S.E	"t"	"p"	SIGNIFICANCE vs INSIGNIFIVANCE
PRE-ECLAMPSIA vs NON-PREGNANT (CONTROL)	0.109	6.14	< 0.001	HIGHYLY SIGNIFICANT
ECLAMPSIA vs NON-PREGNANT (CONTROL)	0.058	5.69	<0.001	HIGHLY SIGNIFICANT

Table 3: SERUM MAGNESIUM LEVELS IN PRE-ECLAMPSIA , ECLAMPSIA AND NORMAL PREGNANT(THIRD TRIMESTER) GROUPS : COMPARATIVE STUDY

GROUPS	SERUM MAGNESIUM LEVEL IN mEq/L			
	S.E	"t"	"p"	SIGNIFICANCE vs INSIGNIFIVANCE
PRE-ECLAMPSIA vs THIRD TRIMESTER PREGNANT	0.088	2.84	< 0.01	SIGNIFICANT
ECLAMPSIA vs THIRD TRIMESTER PREGNANT	0.053	17.1	<0.01	SIGNIFICANT

Table 4: SERUM MAGNESIUM LEVELS IN PRE-ECLAMPSIA AND ECLAMPSIA : COMPARATIVE STUDY)

GROUPS	SERUM MAGNESIUM LEVEL IN mEq/L			
	S.E	"t"	"p"	SIGNIFICANCE vs INSIGNIFIVANCE
PRE-ECLAMPSIA vs ECLAMPSIA	0.080	4.26	< 0.001	HIGHLY SIGNIFICANT

DISCUSSION :

The Magnesium concentration in serum is closely regulated within the range of 0.7 to 1.0 mmol/L(1.5 to 2.0 mEq/L ,1.7 to 2.4 mg/dl –Harrison).According to Mehta and Chapparwal6 the normal mean serum magnesium ranges from 1.0 to 2.2 mEq/L. If plasma concentration of magnesium is less than 1.2 mg/dl (Harrison), it is called hypomagnesemia, a condition which is found frequently in Gestational Hypertension.

The magnesium balance in the body is maintained by the physiological phenomenon of absorption, body requirement and excretion. In healthy subjects, the urinary excretion is directly propotional to the magnesium intake. It passes freely through glomerular filtration and is reabsorbed from the tubules in varying degrees. Placental transport of magnesium from maternal serum to that of fetus also seems to decrease the plasma magnesium level.

The present work aims at throwing light on the serum magnesium level in different trimesters of normal pregnancy and in toxaemias of pregnancy. The study group comprised of a total of 120 cases of which 72 cases were normal pregnant women in different trimesters of gestation and 48 cases were patients with toxaemia of pregnancy. The control group for this study includes normal non-pregnant women in the child-bearing age group.

The study of magnesium metabolism was much neglected because the estimation of this cation was difficult and no technique is completely satisfactory. In the present study , serum magnesium was determined by colorimetric method using Titan Yellow" as proposed by Neil and Neely(1956). Atomic absorption spectrophotometry is recent, accurate and sophisticated mehod.

SERUM MAGNESIUM LEVEL IN THE CONTROL GROUP

A control group has also been investigated in order to establish the level and range of serum magnesium in normal women of reproductive age. This control group comprises of subjects of different age, parity, dietary habits, and socio-economic status selected from among the women of child-bearing age. The serum magnesium level in this group was found to be 2.21 mEq/L +- 0.28 S.D. with the values ranging between 1.8 to 2.7 mEq/L (Table 1).The influence of the above parameters on the serum magnesium level, has been studied with a view to establishing a normal range of serum magnesium level in women of reproductive age.

In the present series, the mean serum magnesium level in Pre-Eclampsia (8 cases) was 1.54mEq/L +- 0.2 S.D with a range of 1.2 to 1.8 whereas the mean in Eclamptics (40 cases) was 0.88 mEq/L +-0.20 with a range of 0.5 to 1.2 .Achari et al (1961)1 found mean serum magnesium value in eclampsia to be 0.99 mg/dl +- 0.40 S.D.

Age and Parity of the patient do not influence the serum magnesium levels in toxaemias of pregnancy.This is consistent for the control and the normal pregnant group. However, serum magnesium levels in patients with toxaemias of pregnancy was found to be low in all socio-economic groups and did not vary significantly with declining socio-economic status.

This consistently lower level of serum magnesium in toxaemias of pregnancy as compared to normal pregnancy, is in agreement

with the findings of many workers (Gupta et al 1979 ; Singh et al 19795 ;Haury4 and Cantarow 19422 ; Greenwald 1963).They considered this decrease in serum magnesium to be a result of hypervolemia and hypoalbuminemia. A multitude of factors have been implicated as being responsible for the declining serum magnesium levels in toxaemia :-

1) Role of Aldosterone : Hypomagnesemia and negative magnesium balance has been observed in primary aldosteronism. Aldosterone increases the urinary excretion of magnesium. Toxaemia has been shown to cause secondary aldosteronism. (Flink et al ,1957).

2) Role of Albumin : Magnesium is bound to albumin. There is excessive urinary excretion of albumin in toxaemia thus causing hypomagnesemia.

3) Role of Vasopressin : Nelson (1964), reported that increase vasopressin level in toxaemia of pregnancy increases the rate of magnesium excretion in urine.

4) Disturbed renal function : Pradhan et al (1964) stated that if the renal tubules are damaged , reabsorption will be diminished resulting in hypomagnesemia while the high concentration may result from reduced glomerular filtration due to damaged glomeruli.

In the present study, highly significant lowering of serum magnesium values were observed in toxaemia cases in comparison to normal non-pregnant (control) group(Table 2).Similar findings were also reported by Achari et al (1961)1.However, no difference in serum magnesium concentration was noted in normal and toxaemia group by Nayar (1940); Chesley and Tepper (1957)3 and Hall (1957).

It was observed that mean serum magnesium level was significantly lowered in toxaemias of pregnancy when compared with the mean serum magnesium level of cases in the third trimester of normal pregnancy (Table 3).

Finally, Table 4 shows that serum magnesium level falls further with the onset of eclampsia. The comparison of serum magnesium levels in Pre-eclamptics and eclamptics shows that the decline is highly significant ($p < 0.001$).

Correlating the findings of the present series with others, it is thus stated that serum magnesium level signifies a diagnostic and prognostic value. Gestational Hypertension requires active and adequate management to avoid its catastrophic events .Unfortunately, inspite of continuous scientific probe into understanding of the pathophysiology of this disease the causative factors responsible for this condition are unclear till. However, in many studies gestational hypertension has been found to be associated with hypomagnesemia9. Its incidence can hence be lowered by taking diet rich in magnesium.

SUMMARY AND CONCLUSION

Serum magnesium level was estimated in normal women in the reproductive phase of life, in normal pregnant women in three trimesters of pregnancy and in women whom pregnancy was complicated by pre-eclampsia or eclampsia.

The co-existence of toxaemic conditions of pregnancy like pre-eclampsia and eclampsia, further reduces the serum magnesium level in comparison to non-pregnant and uncomplicated pregnancies.

Further serum magnesium levels were significantly lower in patients with eclampsia when compared with the serum magnesium levels of pre-eclamptic patients.

The variations observed between normal cases ,in toxaemias of pregnancy have been discussed in the light of findings obtained in this study and correlated with observations made by others.

This work is an attempt to revisit and reaffirm previous claims by independent workers that serum magnesium level is reduced in pregnancy induced hypertension.

To conclude,it would be advisable to recommend additional magnesium supplementation to the pregnant woman to combat hypomagnesemia with advancement of gestational age, particular attention should be paid to patient developing Gestational Hypertension.

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