Serum Magnesium Levels in Normal and Pre-Eclamptic Gestation in Benin City

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SUMMARY

Introduction: Preeclampsia is a major cause of maternal and perinatal morbidity and mortality worldwide. There is at the moment no reliable marker for pre-eclampsia.

Objective: To compare the serum magnesium levels in pre-eclamptic and normotensive pregnant women in Benin -City, Nigeria.

Methods: A cross-sectional study of serum magnesium levels in normal and preeclamptic gestation in Nigerian women was conducted in a tertiary hospital.

Results: Serum magnesium was determined in 65 pre-eclamptic and 65 normotensive pregnant women. The mean serum magnesium level in the normal pregnant women was 1.06 ± 0.33Mmol/Litre while in preeclampsia it was 0.69 ± 0.14 Mmol/l. The difference was statistically significant (P<0.01). Mean levels of serum magnesium were found to be lower in the third trimester than in the second trimester in both normal and preeclamptic gestation. Therefore serum magnesium decreases with increase in gestational age.

Conclusion. The findings in this study imply that magnesium may be a marker for pre-eclampsia.

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***KEY WORDS*: Serum magnesium; pre-eclampsia maternal and perinatal morbidity and mortality.**

INTRODUCTION

Pre-eclampsia is associated with significant maternal and perinatal morbidity and mortality [1, 2]. Despite a steady reduction in maternal mortality from this disorder in developed countries, it remains one of the most common reasons for a woman to die during pregnancy in developing countries[1]. . Pregnancy induced hypertension is classified into three categories: hypertension alone, pre-eclampsia, and eclampsia[3]. Preeclampsia is defined as hypertension on two separate occasions at least 4 hours apart in a previously normotensive, non-proteinuric woman after the 20th week of gestation and accompanied by significant proteinuria, all resolving by 6 weeks postpartum[4]. It is a multisystemic disorder occurring in 2–8% of pregnancies.[1, 5].

Nutritional deficiencies such as magnesium, calcium, zinc and fish oil have been associated with preeclampsia [1,4]. A study has shown that magnesium deficiency is the basis of calcium and magnesium disturbances in preeclampsia, and magnesium sulphate treatment may improve the situation effectively[6]. Another study suggested that low dose magnesium gluconate may efficiently prevent preeclampsia in high risk women and that the mechanism of action probably involves keeping the balance of prostacycline and thromboxane A_2[7]. One postulated theory is that low serum calcium stimulates parathyroid hormone or renin release, thereby increasing intracellular calcium in vascular smooth muscle leading to vasoconstriction[8]. Other workers have suggested that low calcium influences the production of other vasoactive agents such as nitric oxide and prostacycline[9]. Zinc deficiency in placenta tissue might cause insufficiency of superoxide dismutase, an antioxidant enzyme[10]. Also placental zinc plays a role in connective tissue biosynthesis and its lack might affect the integrity of spiral arteries[10]. Fish oil is known to reduce the formation of thromboxane A_2 with little or no effect on prostacycline[3].

While most studies on magnesium levels in pre-eclamptic gestation have occurred in developed nations, there has been paucity of literature in developing nations where most of the maternal deaths from pre-eclampsia occur[11]. The identification of a marker for developing pre-eclampsia is essential to designing strategies to reduce the incidence of maternal and perinatal morbidity and mortality from pre-eclampsia.

The objective of this study was to measure serum magnesium levels in preeclamptic and normotensive pregnant women and compare these levels in Benin -City, Nigeria.

MATERIALS AND METHOD

This was a cross sectional study conducted in the Department of Obstetrics and Gynaecology, University of Benin Teaching Hospital, Benin City. The study population consisted of 65 antenatal patients of gestational age greater than 20 weeks with preeclampsia seen in the antenatal clinic. For each recruited case the next normotensive patient that matched her was recruited as control. Serum magnesium estimation was done in all patients who were between 21 weeks gestation and 42 weeks gestation. Those in second trimester were from 21-27 weeks gestation while third trimester was from 28-42 weeks. The exclusion criteria included, patients with medical complications such as essential hypertention, renal disorders, cardiovascular disorder and those with history of magnesium ingestion.

The diagnosis of hypertension in pregnancy was based on either; one measurement of diastolic blood pressure equal to or greater than 110mmHg or two consecutive measurements of

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diastolic blood pressure equal to or greater than 90mmHg, 4 or more hours apart[4]. Korokoff phase V was used as a measure of diastolic pressure. Significant proteinuria was defined as; one 24 hour collection with a total protein excretion of 300mg or more; or two random clean-catch or catheter specimen urine specimens with 2+(1g albumin/liter) or more on reagent strip or 1+ (0.3g albumin/liter) if specific gravity less than 1030 or Ph less than 8.

Fasting blood samples was taken from both subjects and controls and serum magnesium levels estimated by photometric colorimetric test for magnesium with lipid clearing factor (LCF) using a standard kit, Human Magnesium liquicolor supplied by Human of Germany.

Approval for this study was obtained from the ethical committee of the university of Benin Teaching Hospital. Also, the study was carefully explained to the patients and their informed consent obtained before being recruited into the study.

Results obtained were recorded on a data collection sheet designed for the study. The coded data was then fed into the computer using the EPI. Info program and a comparative analysis was done. Observed differences were evaluated for statistical significance using the student t test. The level of significance value was set at $P< 0.05$.

RESULTS

Table 1 shows that the mean serum magnesium levels in the pre-eclamptics was 0.69 ± 0.14 mM/Litre. This was significantly lower than the serum magnesium level in normotensive pregnancies of 1.06 ± 0.33 mM/Litre (P= 0.01). The range of serum magnesium in the pre-eclamptics was 0.55 – 0.83 mM/Litre while in normal pregnancies, it was between 0.73–1.36 mM/Litre.

The total number of patients in the second trimester was 16 with 8 in each group while in the third trimester; the total number was 114 with 57 in each group. Mean serum magnesium levels in both second and third trimesters was significantly lower in pre-eclampsia than in normotensives (P<0.03). Furthermore in both pre-eclampsia and normal pregnancies, third trimester mean magnesium levels were lower than the second trimester levels.

DISCUSSION

This study found a statistically significant lower level of serum magnesium in pre-eclamptics compared to normotensive pregnancies. Our observation is similar to the findings of majority of previous authors[12,13,14.] The etiology of reduced levels of magnesium in preeclampsia is uncertain. It is unclear whether low serum magnesium result in pre eclampsia or preeclampsia causes hypomagnesaemia. However, recent research by other workers have raised the possibility that magnesium supplementation may be useful in the prevention of pre eclampsia[7,15]. McCarty MF suggested that oral magnesium taurate should be a component of prenatal supplementation and that it might well have both preventive and therapeutic value in preeclampsia[16]. Magnesium and taurine have hypoxia protective actions, supplementation might also protect foetuses experiencing temporary perinatal asphyxia, lessening the risk of cerebral palsy[16]. There is clear evidence in favour of magnesium sulphate when compared with other anticonvulsants in management of preeclampsia. Magnesium sulphate more than halves the risk of eclampsia, and probably reduces the risk of maternal death[17]. Touyz RM emphasized that magnesium rich diet should be encouraged in the prevention of hypertension, particularly in predisposed communities[18]. A lot of researchers have postulated different preventive measures with different results. There is yet no definitive preventive measure. Most studies have been tailored to meet sociocultural and geographic background different from ours. There is therefore the need to carry out more studies on this subject in our locality.

Calcium supplementation has been recommended in the prevention of pre-eclampsia in areas with low dietary calcium intake[19]. At present there is not enough evidence to support routine calcium supplementation of all pregnant women[20]. Current evidence does not sufficiently support the use of zinc as a way to protect against preeclampsia[10].

Population with a very high intake of fish oils also appear to have a low incidence of preeclampsia[3]. Data from several randomized trials using fish oil have failed to demonstrate any reduction in the incidence of preeclampsia[3]. To the contrary, Handwerker and Altura found that serum magnesium levels are maintained in pre-eclampsia and eclampsia [21.]

The finding that mean serum magnesium levels were higher in the second trimester than in the third trimester is in line with previous observations that demonstrated a gradual fall in serum magnesium levels with advancing pregnancy[12,13,22]. Presumably the fall in the levels of magnesium with advancing gestation is sequel to metabolic changes associated with

Table 1: Serum magnesium levels of pre-eclamptics and normotensive pregnancy.

Parameter	Pre-eclampsia mM/L	Frequency 65	Normotensives mM/L	Frequency n=65	P value
Gestational Age (Weeks)					
2nd Trimester (21-26)	0.82 ± 0.26	8	1.31 ± 0.50	8	0.02
3rd Trimester (27-42)	0.68 ± 0.11	57	1.04 ± 0.31	57	0.02
Both Trimesters	0.69 ± 0.14	65	1.06 ± 0.33	65	0.01

pregnancy and possibly from increased magnesium requirement of a rapidly growing fetus.

The findings in this study imply that low levels of serum magnesium in pre-eclampsia is more than a casual relationship and that magnesium may be a marker for pre-eclampsia. Further research is clearly required. One that readily comes to mind would be to estimate the serum magnesium in a cohort of primigravidae before 20 weeks gestation and correlate results obtained with subsequent development of pre eclampsia. This will give more conclusive evidence on whether a low magnesium level is a marker for preeclampsia or not.

The low serum magnesium levels found in this study may also suggest that there is a need for magnesium supplementation and this may be beneficial in reducing the incidence of preeclampsia in our environment. For a country like Nigeria where the maternal mortality rate is very high and for which pre-eclampsia/eclampsia is a major contributor, research into the identification of early markers of this disease is of utmost importance.

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