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ORIGINAL PAPER

A Comparative Study of Serum Magnesium and Serum Inorganic Phosphate Concentration in Hypertensive and Normotensive Women

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ABSTRACT

***Background:** Hypertensive disorders during pregnancy are one of the main causes of maternal death worldwide. Hypertensive disorder during the period of pregnancy is a major cause of maternal death in lndia and also the rest of the world. Derangement of serum magnesium concentration in pregnant women may lead to develop preeclampsia. Therefore there may be a relationship between hypomagnesaemia and preeclampsia. Aim: This study was undertaken to assess serum Magnesium and Serum Inorganic Phosphate concentration in hypertensive and normotensive pregnant women in their 3rd trimester of pregnancy. **Methods**: The present study comprised of 100 cases of normotensive pregnant women and 100 cases of clinically established Hypertensive Pregnant women in their 3rd trimester. Serum Magnesium and Phosphate were estimated in Semi-auto analyzer from the study sample. Using Microsoft Excel software performed statistical analysis of the data. **Results**: Mean Magnesium concentration in hypertensive is 2±0.25 meq/l and in normotensive is 2.3±0.35 meq/l. The serum Magnesium concentration was found to be significantly lower ($p<0.0001$) in hypertensive study participants than in the normotensives participant. **Conclusion**: Magnesium can very well be used as biochemical markers of the new onset hypertensive pregnant women and also can be used in better management of established cases of eclampsia or preeclampsia patients.*

***Keywords:** Magnesium, Phosphorus, Pre-eclamsia, Eclamsia*

INTRODUCTION

Hypertensive disorders during pregnancy are one of the main causes of maternal death worldwide. Hypertensive disorders complicating pregnancy are common and form one of the deadly triad, along with hemorrhage and infection that contribute greatly to maternal morbidity and mortality. Hypertensive disorder during the period of pregnancy is a major cause of maternal death in lndia and also the rest of the world. Eclampsia is an acute disorder of pregnancy, labour and puerpuerium, characterized by Pree clampsia with convulsion followed by loss of consciousness with or without oedema.The incidence and prevalence of hypertensive disorders in pregnancy is about 7-10%.[1]

During pregnancy estimation of serum magnesium levels may be a useful parameter. In high risk pregnancy women Magnesium supplementation should be considered.[2] Magnesium is the second most cation found within the cells of body. Serum levels of magnesium range from 1.5 to 2.1 meq/l.[3]

Magnesium is antagonist to calcium physiologically. During reperfusion, Magnesium attempts to mitigate cellular injury by calcium. So they try to influx, this could explain why magnesium is reduced in the blood.[4]

Magnesium has been shown to be an effective treatment option for the prevention of eclampsia. Its mechanism of action is likely to be both vascular and neurological. Due to antagonist effect to calcium, its effect on vascular smooth muscle to promote relaxation and vasodilation which may lead to lowering of total peripheral vascular resistance. Moreover, Magnesium may have an effect on the cerebral endothelium to limit vasogenic edema by decreasing stress fiber contraction and paracellular permeability via calcium-dependent second messenger systems. In addition, Magnesium may also act centrally to inhibit NMDA

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receptors, providing anticonvulsant activity by increasing the seizure threshold.[5]

There are reduced extracellular calcium and magnesium concentrations in patients with pre-eclampsia and eclampsia. Reduced concentration of magnesium may have a cause and affect relationship with these disorders. These data may therefore be found useful when considering interventional management of preeclampsia and eclampsia using magnesium and calcium supplementation.[6]

The ionized and total magnesium concentration is decreased with increasing gestational age, and during normal pregnancy. There is also evidence that derangement of serum magnesium concentration in women who later develop preeclampsia.[7]

Magnesium isinvolved in blood pressure regulation through an intracellular inhibition of NO synthase in endothelial cells.Therefore there may be a relationship between hypomagnesaemia and preeclampsia.[8]

Magnesium sulphate use as a neuroprotectant and antivasospastic agent due to its vasoprotective effect during eclamsia.[9]

One study demonstrated that during normal pregnancy there was decrease in phosphate levels but the concentration of Phosphate was increased in Pregnancy induced Hypertension.[10]

METHODS

The present study comprised of 100 cases of normotensive pregnant women and 100 cases of clinically established Hypertensive Pregnant women in their 3rd trimester. The clinically established hypertensive 100 cases of pregnant women who were admitted in theantenatal ward in the Department of Obstetrics & Gynaecology, at Assam Medical College & Hospital, Dibrugarh were taken as study case group. The 100 cases of age matched normotensive pregnant women in their 3rd trimester were taken as control group.

So, this study was undertaken to assess serum Magnesium and Serum Inorganic Phosphate concentration and also to correlate any difference found in hypertensive and normotensive women in their 3rd trimester of pregnancy.

Inclusion Criteria

Pregnant women in 3rd trimester (>24 weeks of gestation) suffering from hypertension were taken as 'Hypertensive Study Group.'

The cases for study were composed of already diagnosed cases of hypertension on the basis of following criterion: Blood pressure >140/90 mm of Hg on at least two occasions 6 or more hours apart after 24 weeks ofgestation. Only those cases were included from whom informed consent could be taken.

Exclusion Criteria

Patients with history of hypertension, renal disease, collagen vascular disease, diabetes mellitus, severe anaemia, hydatiform mole, multiple pregnancies were excluded from the study.

The venepuncture was done in the cubitalfossa. About 2 ml of blood was transferred to sterile empty vials and samples were centrifuged at 5000 rpm for 10 minutes as soon as after formation of the clot. The supernatant clear serum was then pipetted out using dry piston pipettes with disposable tips. The samples were analysed on the same day. Serum Magnesium and Phosphate were estimated in Semi-auto analyzer from the study sample.

Estimation of Magnesium (Calmagite method)[11]: Magnesium combines with calmagite in an alkaline mediumto form a red coloured complex. lnterference of protein and calcium is eliminated by the addition of chelating agent and detergent. Intensity of the colour formed is proportional to the amount of magnesium present in the sample.

Estimation of Phosphorus (Molybdate U.V method)[12]: Phosphate ions in acidic medium react with ammoniummolybdate to form a phosphomolybdate complex. This complex has anabsorbance in the ultraviolet range and is measured at 340 nm . Intensity of the complex formed is directly proportional to the amount of inorganic phosphorus present in the sample. Phosphorus + Ammonium Molybdate Phosphomolybdate complex**.**

RESULTS AND OBSERVATIONS

The present study is a randomised case control study. Results were analysed by using unpaired student's t-test.

Table 1 Serum Magnesium concentration in hypertensive and normotensive participants

Comparison	Mean Magnesium (meq/L)	S.D	p-value
Hypertensive	2.0	0.25	<0.0001
Normotentive	2.3	0.35	

Table 1 shows that mean Magnesium level in hypertensive is 2±0.25 meq/l and in normotensive is 2.3±0.35 meq/l.Student t-testrevealed very highly significant differences ($p<0.0001$) in magnesium concentration in between hypertensive and normotensive groups.

Table 2 Serum inorganic Phosphate concentration in hypertensive and normotensive participant

Parameter	Hypertensive		Normotensive		p-value
	Mean (mg/dl)	S.D	Mean (mg/dl)	S.D	
Serum Phosphate	4.0	0.53	3.8	0.97	0.07

Table 2 shows the levels of mean serum Inorganic phosphate in the study participants. The mean serum levels of inorganic Phosphate in hypertensive are 4±0.53 mg/dl and in normotensive is 3.8±0.97 mg/dl. Student t-test revealed that the difference was not significant.

DISCUSSION

In the 100 hypertensive cases which were studied, the maximum number of 49 cases (49%) belonged to the 21-25 years age group. The next highest number of 24 cases (24%) were from the age group of 20 years. The highest number of 73 cases were less than 25 years of age. A study done in Saudi Arabia showed that women at extremes of maternal age, the nulliparous women, and high-parity women are at an increased risk of developing pre-eclampsia.[13] According to another study maximum incidence of developing pre-eclamsia was in the age group of 15-25years.[14]

In the present study 67 (67%) cases were primigravidas and 33

(33%) cases were multigravidas in the hypertensive study group. Eclampsia is a very common pregnancy associated disorder in our country mostly affecting primigravida of early age group with poor socioeconomic background.[15] According to another study it was found that Pre-eclamsia mainly affects in first pregnancy.[16]

The analysis of Magnesium in the study participants, show that serum Magnesium concentration was found to be significantly lower ($p<0.0001$) in hypertensive study participants (2.0±0.25 meq/l) than to the normotensives (2.3±0.35 meq/l) participants. One study established that Serum Magnesium concentration was found to be significantly lower in pre-eclamsia patients (1.9±0.37 mg/dl vs. 2.29±0.69 mg/dl, $p<0.01$).[17] The levels of zinc, copper, selenium, manganese and magnesium are significantly altered in pregnant women with pre-eclampsia. In order to get these important elements dietary supplementation or direct replacement therapy of these trace elements is suggested for women with pre-eclampsia (0.5 ± 0.2 meq/l vs 1.0 ± 0.2 meq/l,$p<.0001$).[18] Hypomagnesaemia can be said to be one of the etiological factors in pre-eclampsia and eclampsia. Serial estimation of serum magnesium during antenatal period, pre-eclampsia can be predicted and eclampsia can be prevented early.[19]

The analysis of serum phosphate in the study participants, show that serum phosphate concentration was found to have statistically no significance. The mean phosphate concentration in hypertensive study participants (4.0±0.53 mg/dl) was higher than in the normotensives (3.8±0.97 mg/dl). Hypophosphateuria are important features of severe preeclampsia and probably are indirectly related to the altered renal function seen in toxemia of pregnancy.[20]

So we can suggest that a low serum Magnesium level might be linked to explaining the pathogenesis of preeclampsia.

CONCLUSION

The biochemical test performed gives us the information that lowered Magnesium levels in new onset hypertension of pregnancy could be associated with gestational hypertension. Deranged magnesium may cause a imbalance between the vasodilators and vasoconstrictors resulting in hypertension.From the present study it can be concluded that the level of serum Magnesium significantly decreases with new onset hypertension of pregnancy. Therefore, serial estimation of serum Magnesium can very well be used as biochemical markers of the new onset hypertensive pregnant women and also can be usedin better management of established cases of eclampsia or preeclampsia patients.

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