

Comparison of maternal serum magnesium level in eclampsia, preeclampsia and normal pregnant women admitted to El-Shatby Maternity Hospital

Original
Article

Mohammed A. Farag, Zinab El-Baz, El-Habashy Ahmed

Department of Obstetrics and Gynaecology, Faculty of Medicine, Alexandria University, Alexandria, Egypt

ABSTRACT

Background: Preeclampsia is a pregnancy multisystem disorder of unknown etiology. It is a significant cause of maternal and fetal morbidity and mortality. Magnesium may be physiologically important in blood pressure regulation whereas changes in magnesium levels could contribute to the patho-etiology of hypertension.

Objective: comparison of the level of serum magnesium between preeclamptic, eclamptic patients and normal pregnant women.

Materials and Methods: This case-control study was conducted on 250 patients at EL-Shatby Maternity University Hospital. 100 cases were preeclamptic, 100 cases were eclamptic and 50 cases were normal pregnancy (control group).

Results: Serum magnesium was higher in eclamptic and preeclamptic women compared to normal pregnant women. In eclampsia serum magnesium was markedly reduced than in pre-eclampsia.

Conclusion: Serum magnesium is lower in PET cases versus normal pregnant cases. This might supported the hypothesis that Mg deficiency might be the causative factor in the development of preeclampsia and eclampsia.

Key Words: Eclampsia, magnesium, preeclampsia.

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Corresponding Author: Mohammed A. Farag, Department of Obstetrics and Gynaecology, Faculty of Medicine, Alexandria University, Egypt, **Tel.:** 01223338245, **E-mail:** drmohamedfarag237@gmail.com

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INTRODUCTION

Hypertensive disorders in pregnancy complicate 5-10% of pregnant females and are the main one of the reasons of maternal mortality in the world. Preeclampsia is considered severe if there is multiorgans dysfunction like pulmonary edema, oliguria (urine less than 500 ml per 24 hours), thrombocytopenia (platelet count reduced to less than 100,000/mm³), abnormal liver enzymes in association with persistent epigastric or right upper quadrant pain, or persistent severe central nervous system signs (altered mental status, headaches, blurred vision or blindness).^[1]

Magnesium is one of the main electrolytes in the body, it is a co-factor of frequent metabolic procedures specially those taking place in the neurological, reproductive, cardiovascular and immune organizations. About 25% of magnesium is in the binding form with albumin which is the major binding protein. Consequently, variations in serum albumin levels may distress both ionized and total magnesium concentrations.^[2,3]

Magnesium deficiency in pregnancy can lead to maternal and fetal complications. Magnesium lack is correlated with uterine hyper-excitability, preterm

labor, intrauterine growth restriction and preeclampsia. Magnesium deficiency may cause alteration in regulation of body temperature in neonate and it is one of the causes of sudden neonatal mortality syndrome. Use of antenatal Magnesium sulfate had been suggested for neonatal neuroprotection.^[4,5]

Blood pressure is affected by magnesium level that mediate vascular tone and constriction via biochemical activates that regulate vascular contraction/dilation, growth/apoptosis and inflammation. Furthermore, lack of this mineral has been linked to oxidative stress, pro-inflammatory state, endothelial dysfunction, platelet combination, insulin resistance and hyperglycaemia.^[6]

Thus, magnesium might be physiologically vital in blood pressure regulation and variations in magnesium levels may be related to the patho-etiology of hypertension.^[5,6]

AIM OF THE STUDY

The objective of this work was to compare the level of serum magnesium between preeclamptic, eclamptic patients and normal pregnant women during the third trimester at El-Shatby Maternity University Hospital.

PATIENTS AND METHODS

This case-control study was conducted on 250 patients at EL-Shatby Maternity University Hospital who are admitted for symptoms and signs of preeclampsia and normal pregnancy as a control group.

The patients was divided into 3 groups:

Group I included 100 of the patients were preeclamptic group

Group II included 100 patients were eclamptic group.

Group III included 50 women were normal pregnancy (normotensive)

Inclusion criteria:

- 1) Gestational age : ≥ 28 weeks
- 2) Singleton pregnancy
- 3) PET criteria according to ACOG

Exclusion criteria:

- 1) Any disease associated with pregnancy and cause proteinuria.(systemic lupus, diabetes, chronic hypertension)
- 2) Presence of gross congenital anomalies
- 3) Any neurological or psychological disorders that lead to convulsions
- 4) Any drug which affect serum calcium and magnesium level

METHODS:

All cases in the three groups were subjected to the following:

1. History & general examination including BMI & blood pressure.
2. Laboratory investigations including:
 - Liver function tests: Alanine aminotransferase (ALT), aspartate aminotransferase (AST) and total bilirubin
 - Renal function tests: serum creatinine and blood urea nitrogen (BUN)
 - Serum magnesium

3 Ultrasonographic examination including:

- Assessment of amount of liquor
- Fetal movements

4 We documented the mode of delivery for all cases

RESULTS

The basic demographic and clinical data of the three studied groups showed that the age, gestational age and body mass index show insignificant difference between the three studied group, the systolic and diastolic blood pressure show a highly significant increase in eclamptic group more than preeclamptic group and control group, also the preeclamptic group show a significant increase in both systolic and diastolic blood pressure more than the control group as shown in (Table 1).

The laboratory findings of the three studied groups showed that the liver functions tests (which include ALT and AST) and kidney functions tests (which include urea and creatinine) show insignificant difference between the three studied groups, as shown in (Table 2).

The serum magnesium in preeclamptic group was 1.27 ± 0.35 mg/dl, in eclamptic group it was 1.01 ± 0.33 mg/dl while in control group it was 2.09 ± 0.52 mg/dl. Serum magnesium was significantly lower in eclamptic group than preeclamptic and control groups. On the other hand serum magnesium was significantly lower in preeclamptic group than the control group ($p < 0.01$) as shown in (Table 3 and Figure 1).

The ultrasound findings of the three studied groups shows that the amount of liquor was adequate in the control group, while it was significantly lower in both eclamptic and preeclamptic group. The fetal movement was normal in 84.0% of preeclamptic and 77.0% of eclamptic group. Fetal movement was significantly lower in both preeclamptic and eclamptic group in comparison to the control group. The mode of delivery was cesarean section in 34.0% of preeclamptic group, 47.0% of eclamptic group and 24.0% of control group. There was a significant increase in cesarean section delivery rate in both preeclamptic and eclamptic group in comparison to the control group as shown in (Table 4).

The sensitivity, specificity and accuracy of serum magnesium in predict preeclampsia and eclampsia, shows that at cut off value less than 1.6 mg/dl and more than 1.25 mg/dl the sensitivity of prediction of preeclampsia was 82.0%, specificity was 79.0% and total accuracy was 80.0%. While at cut off value less than 1.25 mg/dl the prediction of eclampsia was 92.0%, and sensitivity was 89.0% and total accuracy was 90.0% as shown in (Table 5).

The serum magnesium shows a positive significant correlation with both systolic and diastolic blood pressure,

while the correlation between serum magnesium with other laboratory findings was insignificant as shown in (Table 6).

Table 1: Basic demographic and clinical data of the studied groups.

	Preeclamptic group	Eclamptic group.	Control group	<i>P value</i>
Age	26.21±3.18	26.17±3.27	26.06±3.12	0.964
Gestational age	33.72±3.17	33.89±3.20	34.18±2.91	0.698
BMI	27.20±1.89	27.17±1.93	27.49±1.91	0.589
Systolic blood pressure	169.73±6.38	185.42±5.78	101.76±4.98	0.001*
Diastolic blood pressure	118.12±4.53	124.29±3.07	77.02±4.76	0.001*

*: statistically significant

Table 2: Laboratory findings of the studied groups.

mg/dl	Preeclamptic group	Eclamptic group.	Control group	<i>P value</i>
ALT	28.92±6.84	28.45±7.16	27.12±6.48	0.320
AST	28.44±7.12	28.40±7.28	27.58±6.32	0.751
Urea	19.64±5.24	20.29±4.83	20.42±5.23	0.566
Creatinine	0.90±0.20	0.91±0.21	0.94±0.18	0.458

Table 3: Serum magnesium of the studied groups.

	Preeclamptic group	Eclamptic group.	Control group	<i>P value</i>
Serum magnesium (mg/dl)	1.27±0.35	1.01±0.33	2.09±0.52	0.001*

*: statistically significant

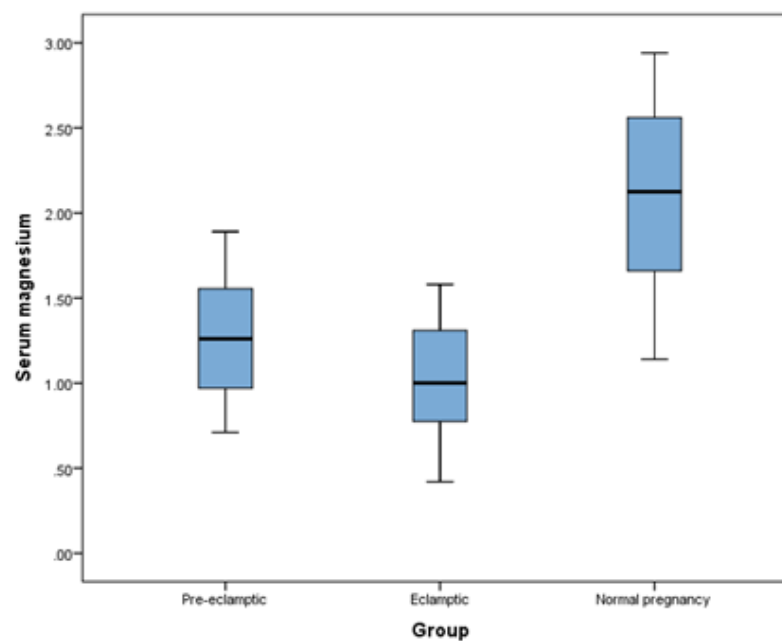


Fig. 1: Box plot of Serum magnesium of the studied groups.

Table 4: Ultrasound finding of the studied groups.

	Preeclamptic group		Eclamptic group.		Control group		<i>P value</i>
	No.	%	No.	%	No.	%	
Amount of liquor							
Adequate	80	80.0	82	82.0	50	100.0	0.003*
Non adequate	20	20.0	18	18.0	0	0.0	
Fetal movement							
Normal	84	84.0	77	77.0	50	100.0	0.001*
Decreased	16	16.0	23	23.0	0.0	0.0	
Mode of delivery							
Normal vaginal delivery	66	66.0	53	53.0	38	76.0	0.200
Cesarean section	34	34.0	47	47.0	12	24.0	

*: statistically significant

Table 5: Sensitivity, specificity and accuracy of serum magnesium in predict preclamptic and eclamptic.

	Area under the curve	Cut off value	<i>P value</i>	Sensitivity	Specificity	Accuracy
				%	%	%
Pre eclampsia	0.825	<1.6	0.0021*	82.0	79.0	80.0
Eclampsia	0.928	<1.25	0.001*	92.0	89.0	90.0

*: statistically significant

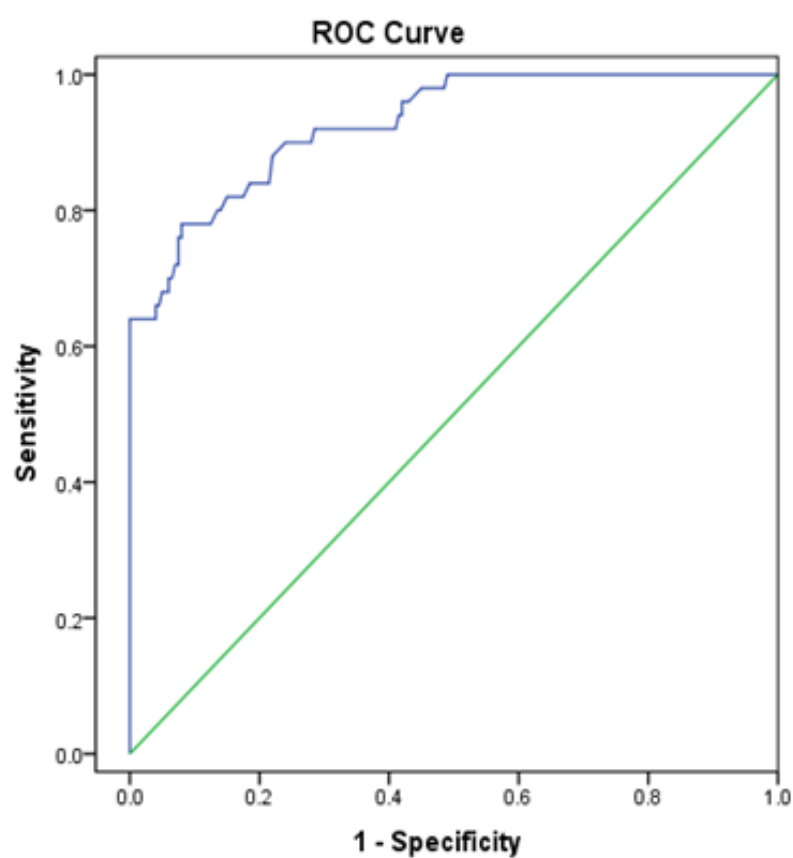
**Fig. 2:** ROC curve of serum magnesium to predict the preclampsia and eclampsia.

Table 6: Correlation between serum magnesium in relation to laboratory findings and blood pressure

Serum magnesium	Pearson Correlation	P value
SBP	-.710	0.001*
DBP	-.697	0.001*
ALT	-.050	.435
AST	-.109	.086
Urea	-.048	.452
Cr	-.021	.742

*: statistically significant

DISCUSSION

Pre-eclampsia is a pregnancy multisystem disorder of unknown etiology. It is a significant cause of maternal and fetal morbidity and mortality. Magnesium may be physiologically important in blood pressure regulation whereas changes in magnesium levels could contribute to the patho-etiology of hypertension.^[1-3]

Our study was case control study that included 250 women divided into 3 groups. 100 cases were pre-eclamptic, 100 cases were eclamptic and 50 cases were normotensive controls. Our aim was to compare the serum magnesium level in the 3 groups. We found that the serum magnesium was higher in eclamptic and preeclamptic women compared to normal pregnant women. In eclampsia serum magnesium was markedly reduced than in pre-eclampsia.

Tavana *et al* compared the magnesium level between preclamptic cases and normal pregnant women at mid-trimester. They concluded that serum magnesium was significantly lower in pre-eclamptic cases, which matches with our finding. They attributed that to the increased magnesium renal clearance in pre-eclampsia.^[7]

Jain *et al* measured the serum magnesium level in 100 pregnant women (25 of them had mild pre-eclampsia, 25 had severe pre-eclampsia and 50 were normal control). They conclude that serum magnesium level was significantly lower in pre-eclamptic cases versus normotensive pregnant women. Their conclusion was similar to ours. They postulated that magnesium may play a role in endothelial integrity through its effect on production of prostacyclin from endothelium which has vasodilator and platelet adherence inhibition effects.^[8] of magnesium results in depletion of endogenous gamma amino butyric

Sukonpan *et al* studied the serum magnesium level in 80 pregnant females (half of them are pre-eclamptic and half of them are normal controls). Like our results, they found that magnesium level is also lower in pre-eclamptic cases and thus they postulated that hypomagnesemia may had a role in the etiology of pre-eclampsia.^[9]

Eprahim *et al* found that there were no correlation between serum magnesium level and systolic blood pressure. Also Punthumapol *et al* found that there was no difference in serum magnesium level between normal pregnant women and pre-eclamptic cases. The findings of Eprahim *et al* and Punthumapol were in contrary to our results. This inconsistency can be explained by the differences of dietary consumption and ethnic background of the studied groups.^[10,11]

CONCLUSION

Serum magnesium is lower in PET cases versus normal pregnant cases. This might supported the hypothesis that Mg deficiency might be the causative factor in the development of preeclampsia and eclampsia.

CONFLICT OF INTEREST

There are no conflicts of interests.

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