

A COMPARATIVE STUDY OF SERUM CALCIUM, MAGNESIUM AND URIC ACID LEVELS IN WOMEN WITH PRE-ECLAMPSIA AND NORMAL PREGNANCY

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Abstract:

Background: Physiologically calcium plays a critical role in function of smooth muscle and its deficiency can cause increased blood pressure. Magnesium is a cofactor in several enzymes, cause vasodilatation and helps in neurochemical transmission. Besides magnesium and calcium, hyperuricemia may induce hypertension by impairing nitric oxide generation

Objective: To compare serum calcium, magnesium and uric acid levels in women with pre-eclampsia and normal pregnancy

Methods: Hospital based Comparative Cross sectional study was carried out among 60 (30 pre-eclampsia and 30 normal pregnant women) aged 18-35 years between 20 weeks till term gestation for 18 months. Proteinuria, serum Calcium, Serum Magnesium, and serum Uric acid were measured using standard procedures.

Results: Majority were (40%) 25-29 years, (53.3%) were overweight, 46.6% had 36-38 weeks of gestation. 56.67% were Primi. 60% had severe preeclampsia. Proteinuria was seen in all with 46.67% had 2+. Pulse rate, SBP and DBP were significantly higher among the cases compared to controls. Serum calcium was significantly lower among preeclampsia women and serum uric acid was significantly higher. However there was no statistically significant difference between serum magnesium levels among preeclampsia and normal pregnant women. There was no statistically significant difference between pulse rates. Systolic and diastolic blood pressure were significantly higher in severe preeclampsia group. Serum Calcium and magnesium were significantly lower in severe preeclampsia group.

Conclusion: Preeclampsia was found to be associated with low calcium levels and higher serum uric acid levels. But it was not found to be associated with the serum magnesium levels.

Key words: calcium, magnesium, uric acid, pre-eclampsia, pregnancy

INTRODUCTION

Preeclampsia is a multisystem disorder. The cause is not known. There is increase in the blood pressure up to 140/90 mmHg and this can be found on more than twice with an interval of six hours. There is also proteinuria (>300mg/>1+dipstick). It is usually seen after 20 weeks of gestation. The mother may be having normal blood pressure or no proteinuria before. ^[1]

Globally, the incidence of preeclampsia is reported to vary from 2-10%. It is reported to be 8-10% in India. Prevalence of hypertensive disorders was 7.8% as per one study and the prevalence of preeclampsia was 5.4%. ^[2]

Although etiology of preeclampsia is not well defined, however placental ischemia due to abnormal trophoblastic invasion of uterine vessels is considered to have a major role in pathogenesis. Molecular basis of this condition is still unresolved. Recent studies have shown the relationship between the hypertensive complications and changes in concentration of various biochemical parameters such as serum uric acid, calcium, magnesium in preeclampsia women. ^[3, 4, 5]

Physiologically calcium plays a critical role in function of smooth muscle and its deficiency can cause increased blood pressure. Magnesium is a cofactor in several enzymes, cause vasodilatation and helps in neurochemical transmission. ^[4] Besides magnesium and calcium, hyperuricemia (which results from impaired renal function) may induce hypertension by impairing nitric oxide generation. ^[6]

Present study was carried out to compare serum calcium, magnesium and uric acid levels in women with pre-eclampsia and normal pregnancy

MATERIALS AND METHODS

Hospital based Comparative Cross sectional study was carried out among pregnant women aged between 18-35 years with preeclampsia and normal pregnant women, between 20 weeks till term gestation using convenient sampling method. 60 (30 pre-eclampsia and 30 normal pregnant women) women were included in the present study which was carried out for 18 months from (1st January 2020 to 30th August 2021) at Malla Reddy Institute of Medical Sciences, Suraram, Department of Obstetrics and Gynecology.

Exclusion criteria

- 1) Women aged >35years and <18years.
- 2) Medical illness such as DM, hypothyroidism, epilepsy, known hypertensive, renal

diseases, gout and autoimmune disorders such as SLE.

- 3) Multiple gestation
- 4) Intrauterine death
- 5) Patients unwilling to undergo required tests.

Inclusion criteria

- 1) Pregnant women diagnosed with preeclampsia from 20weeks till term gestation, aged between 18-35 years, irrespective of parity.
- 2) Single live intrauterine fetus.
- 3) Normal pregnant women matched for gestational age, gravida and aged between 18-35years.
- 4) Willing to undergo required tests

Examination of pedal edema was carried out. Height and weight was measured as per the standard guidelines. Body mass index was calculated by dividing weight in kg by height in meter squared. Measurement of Blood pressure was done as per standard protocol. It was measured twice with an interval of more than six hours.

Estimation of Proteinuria was done by taking early morning urine sample and using the dipstick method. Blood sample collection was done using all aseptic precautions. Serum was separated using centrifuge machine which was rotated for 10 min at 3,000 revolutions per minute.

Estimation of Calcium, Serum Magnesium, and serum Uric acid was done using standard procedures and standardized machines.

Statistical analysis: The data was entered in Microsoft Excel worksheet. The data was expressed as proportions and mean. Student's t test was used to compare means in two groups of cases. P value less than 0.05 was considered as statistically significant.

RESULTS

Table 1: Distribution of cases according to baseline characteristics

Characteristics		Number	%
Age (years)	< 20	4	13.3
	21-24	8	26.7
	25-29	12	40
	30 and above	6	20
Body mass index	< 24.99	5	16.7

(kg/m ²)	25-29.99	16	53.3
	30-34.99	7	23.3
	> 35	2	6.7
Gestational age (weeks)	30-32	3	10
	32-34	2	6.7
	34-36	7	23.3
	36-38	14	46.7
	38-40	4	13.3
Gravidity	G1	17	56.7
	G2	11	36.7
	G3	2	6.6

Majority of pregnant women were (40%) belonged to age group of 25-29 years. Most of them (53.3%) were overweight with BMI 25-29.99. 46.6% had 36-38 weeks of gestation. Among the cases, 56.67% were Primi. (Table 1)

Table 2: Distribution of cases according to severity of preeclampsia and degree of proteinuria

Variables		Frequency	Percentage
Preeclampsia	Non-severe	12	40
	Severe	18	60
Urine albumin	+	5	16.7
	++	14	46.7
	+++	11	36.7

Among the cases, 60% had severe preeclampsia, 40% had non-severe preeclampsia. Among the cases, proteinuria was present in all. 16.67% had 1+ 46.67% had 2+, 36.66% had 3+ urine albumin. (Table 2)

Table 3: Comparison of mean values of hemodynamic parameters among preeclampsia women and normal pregnant women

Parameters	Cases (N=30)	Controls (N=30)	P value
Pulse rate	95.6±6.49	84±2.34	<0.0000001
SBP	167.3±22.5	117.33±5.2	<0.0000001
DBP	99.66±8.08	76.33±4.9	<0.0000001

Among the study population, the hemodynamic parameters like pulse rate, SBP and DBP

were significantly higher among the cases compared to controls. (Table 3)

Table 4: Comparison of mean serum values of study parameters among preeclampsia women and normal pregnant women

Parameters	Cases (N=30)	Controls (N=30)	P value
Sr. calcium	8.04±0.47	9.13± 0.53	<0.0000001
Sr. Magnesium	1.75±0.25	1.86±0.32	0.14
Sr. Uric Acid	6.4±0.7	3.66±0.45	<0.0000001

Among the study population, Serum calcium was significantly lower among preeclampsia women and serum uric acid was significantly higher. However there was no statistically significant difference between the serum magnesium levels among preeclampsia and normal pregnant women. (Table 4)

Table 5: Comparison of study parameters among non-severe and severe preeclampsia cases

Parameters	Non-severe Preeclampsia (N=12)	Severe Preeclampsia (N=18)	P value
Pulse rate	95.66±6.25	95.66±6.83	0.9
SBP	144.166±.14	182.77±14.89	<0.0000001
DBP	91.66±3.89	105±5.144	<0.0000001
Sr. calcium	8.49±0.40	7.73± 0.206	0.0000001
Sr. Magnesium	2±0.16	1.59±0.166	0.0000002
Sr. Uric Acid	5.8±0.48	6.8±0.51	0.0000009

Among the study population, there was no statistically significant difference between the pulse rates. Systolic and diastolic blood pressure were significantly higher in severe preeclampsia group. Serum Calcium and magnesium were significantly lower in severe preeclampsia group. (Table 5)

DISCUSSION:

Among the cases, 40% belonged to age group of 25-29 years, 20% belonged to >30 years, 26.67% belonged to 21-24 years, 13.33% belonged to <20 years. Most cases in the study belonged to 25-29 years age group. Preeclampsia is more prevalent in young or elderly Primi gravida (first time exposure to chorionic villi). In the present study, among the cases, 53.33% had BMI around 25-29.99, 23.33% had BMI around 30-34.99, 16.67% had BMI around <24.99, 6.67% had BMI of >35. Most of the cases in the study belonged to BMI around 25-29.9. Body Mass Index of preeclampsia women was significantly higher than that of the normal pregnant women. Punthumapol C et al ^[7] reported similar findings. They observed that hypertension was common in subjects having higher body mass index. Sohlberg S et al

[8] concluded from their study that short stature and overweight and obesity are significant risk factors of preeclampsia. Spradley FT et al [9] added that metabolic factors affect the function of the placenta and hence increased risk of preeclampsia.

In the present study, 56.67% were Primi, 36.67% were gravida – 2, 6.67% were gravida – 3. Most of the cases in the study were Primi. Simon E et al [10] concluded from their study that null parity is an important risk factor for preeclampsia.

In the present study, among the cases, 60% had severe preeclampsia, 40% had non severe preeclampsia. Among the cases, proteinuria was present in all. 16.67% had 1+ 46.67% had 2+, 36.66% had 3+ urine albumin. Sibai BM et al [11] observed that it is not necessary that the proteinuria must be present in all cases of preeclampsia. They found that the proteinuria was absent in 10-15% of mothers with HELLP syndrome. Those women who had seizures, among them 17% had no proteinuria till they developed seizures. Dong X et al [12] also reported that very few women had proteinuria. They also noted that as the degree of proteinuria increased, the severity of the preeclampsia also increased. Ozkara A et al [13] found a significant association between proteinuria and the need for intensive care for the neonates born to these mothers. Neonatal outcome was severely affected with degree of proteinuria.

In the present study, we observed that the pulse, systolic and diastolic blood pressure were more in the preeclampsia group compared to the control group and this difference was found to be statistically significant ($p < 0.05$). Mittal S et al [14] also reported similar findings.

In the present study, serum magnesium levels were comparable in cases and controls ($p > 0.05$). Among mothers with the preeclampsia, the serum calcium levels were lower than compared with mothers without preeclampsia and this difference was found to be statistically significant ($p < 0.05$). But the serum uric levels were higher in the previous group compared to the later which was statistically significant ($p < 0.05$). These findings confirmed the hypothesis that Hypocalcaemia and Hypomagnesaemia may be etiologies in development of Preeclampsia. The mean uric acid levels were more in Preeclampsia than in normal pregnancy. Elevated serum uric acid levels due to decreased renal urate excretion are frequently found in women with Preeclampsia. Soluble uric acid impairs nitric oxide generation in endothelial cells. Thus, hyperuricemia can induce endothelial dysfunction.

Taufield PA et al [15] observed from their study that there is positive association between presence of preeclampsia and the presence of low levels of calcium. This is because of the mechanism of increase in the calcium reabsorption at tubular level. Thus, they suggested to measure the excretion of calcium to differentiate between preeclampsia and other forms of gestational hypertension. Idogun ES et al [16] and Indumati V et al [17] noticed that the levels of serum magnesium and calcium were significantly lower in women with preeclampsia compared to normal women. We also found hypocalcemia but the magnesium levels were comparable in our study. Punthumapol C et al [7] reported findings in agreement with the present study.

In the present study, among the study population, there was no statistically significant difference between the pulse rates. Systolic and diastolic blood pressure were significantly higher in severe pre-eclampsia group. Serum Calcium and magnesium were significantly lower in severe pre-eclampsia group. Serum uric acid was significantly higher in severe pre-eclampsia group.

Uric acid was significantly higher and weight of neonates was significantly lower in pre-eclampsia women. Significant correlations between uric acid and systolic blood pressure, and uric acid and 24-hour proteinuria were observed. Inverse correlations between uric acid levels and weight of newborns and between systolic blood pressure and the weight of newborns were also observed. The results agree with other previous research, and reinforce the idea that the concentration of serum uric acid in pregnant women with pre-eclampsia is associated with disease severity and contributes to better monitoring of the mother and newborn. ^[18]

LIMITATIONS:

The sample size is smaller as only 30 preeclampsia and 30 normal pregnant women are included in the study. Larger studies needs to be done to find significant correlation between serum calcium, magnesium and uric acid levels with preeclampsia and its severity. The present study does not include how to prevent preeclampsia and its complications. Further studies need to be carried out in order to prevent preeclampsia complications with supplementation of calcium and magnesium.

CONCLUSION

Preeclampsia was found to be associated with low calcium levels and higher serum uric acid levels. But it was not found to be associated with the serum magnesium levels. But, these levels cannot be taken as the cause of preeclampsia even though they play an important role in the pathogenesis of preeclampsia. Hence, we recommend based on the findings of the present study that pregnant women should either be given the diet rich in magnesium and calcium or they should be given the supplement of magnesium and calcium. This will help to go for the safe pregnancy and better outcomes of the pregnancy.

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