Research Paper

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Biochemical Changes in Pre-Eclamptic Women

Medical Science

KEYWORDS : Preeclampsia, uric acid, calcium, magnesium, urea, creatinine.

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ABSTRACT

Preeclampsia is one of the most common causes of foetal morbidity and mortality during pregnancy. The present study was done to estimate the serum levels of Uric acid, Calcium, Magnesium, Urea and Creatinine in patients with mild (Group 2) and severe preeclampsia (Group 3) and compare them with healthy controls (Group 1). The study group consisted of 120 pregnant women. Of these, 50 belonged to Group 1, 40 to Group 2 and 30 to Group 3. Results showed that all parameters are increased in mild and severe preeclamptic women when compared to controls. Further, the increase is statistically highly significant ($p < 0.001$) in Group 3 than Group 2 for uric acid and calcium, significant ($p < 0.05$) for magnesium and not significant for urea and creatinine. Thus calcium, magnesium and uric acid may be used as indicators of preeclampsia.

1. INTRODUCTION:

Preeclampsia is one of the most common causes of foetal morbidity and mortality during pregnancy[1]. Its incidence is 4-8% of pregnancies[2]. Exact etiology is not known but it may be due to an increased vascular resistance of uterine artery and decreased perfusion of placenta[3]. Factors such as calcium (Ca^{2+}) deficiency[4], advanced maternal age, oxidative stress; placental ischemia, genetics and immune maladaptation have also been implicated in its etiology[5].

It is clinically defined by hypertension and proteinuria, with or without pathological edema[6]. Mild preeclampsia is defined as blood pressure of atleast 140/90 mmHg on two occasions each 6 hours apart, accompanied by proteinuria of atleast 1+ on dipstick testing. Severe preeclampsia is defined as blood pressure of atleast 160/110 mm Hg on two occasions each 6 hours apart, accompanied by proteinuria of atleast 3+ on dipstick testing.

Uric acid is the final breakdown product of purine degradation in humans. Raised serum uric acid (UA) is one of the characteristic findings in preeclampsia. Reduced UA clearance secondary to reduced glomerular filtration rate, increased reabsorption, and decreased secretion may responsible for elevated serum levels in women with preeclampsia[7].

Physiologically ca^{2+} plays an important role in muscle contraction and regulation of water balance in cells. Low serum calcium may cause high blood pressure by stimulating parathyroid hormone and renin release and also by inducing vasoconstriction by increasing its level in vascular smooth muscle[8, 9]. Magnesium is one of the essential intracellular cautions and an important cofactor for activation of many enzymes. Magnesium has a significant role in pathophysiological regulation of blood pressure because it affects contractility and tone of blood vessels[10].Urea which is the catabolic product of ammonia and an important marker to assess the kidney functions seems to be raised in preeclampsia[11]. Creatinine which is another important marker to assess kidney functions had role in preeclampsia[12].

Keeping this in view, the objective of the present study is to estimate the serum levels of Uric acid, Calcium, Magnesium, Urea and Creatinine in patients with preeclampsia and compare them with healthy controls.

2. MATERIALS & METHODS:

2.1. Study centre & Period: This research was conducted at Department of Biochemistry, Rangaraya Medical College between July 2015 and January 2016.

2.2. Subjects Selection: Patient selection was done by simple random sampling of individuals presenting to the O.P of Department of OBG, Government General Hospital, Kakinada. An informed consent was taken from the patients and controls before the collection of blood sample. The subjects were selected based on following inclusion and exclusion criteria.

2.3. Inclusion Criteria:

- Gestational age >20 weeks.
- Primi or Multigravida women.
- Antenatal women of age 20-35 yrs.
- Controls were healthy individuals; age matched without any major illness.

2.4. Exclusion Criteria:

- Pre-existing hypertension before pregnancy.
- Patients with acute or chronic liver diseases.
- Renal diseases.
- Patients with thyroid disorders.
- Use of antihypertensive drugs etc;
- Gout.

2.5. Study Pattern:

- GROUP 1: CONTROLS - 50 age matched normal pregnant women.
- GROUP 2: CASES – 40 patients with mild preeclampsia and
- GROUP 3: CASES - 30 patients with severe preeclampsia.

2.6. Assay of Markers:

Uric acid in serum was measured by Uricase-Peroxidase method [12], serum calcium by Arsenazo III method, serum magnesium by Calmigate method, serum urea by Berthelot method, serum creatinine by Jaffe's method on Erba Semiautoanalyzer.

2.7. Statistical Analysis:

All results were expressed as Mean ± S.D. The data obtained were analyzed using Student's t-test for p-value.

3. RESULTS & OBSERVATIONS:

The results obtained for various parameters are tabulated as follows -

TABLE 3.1:

Value (mg/dl)	Group 1 (N=50)	Group 2 (N=40)	Group 3 (N=30)	Group 2 + Group 3
Uric Acid	5.08 ± 1.03	6.39 ± 1.02	7.79 ± 1.55	6.98 ± 1.45
Calcium	9.64 ± 0.66	8.68 ± 0.59	7.96 ± 0.72	8.37 ± 0.74
Magnesium	2.09 ± 0.26	1.74 ± 0.24	1.60 ± 0.24	1.68 ± 0.25
Urea	29.56 ± 5.43	30.70 ± 4.84	32.46 ± 5.45	31.45 ± 5.19
Creatinine	0.72 ± 0.36	0.91 ± 0.52	1.02 ± 0.62	0.96 ± 0.58

The values of uric acid, urea and creatinine are increased in Group 2 and Group 3 (cases: Group 3 > Group 2), when compared to Group 1 (controls). On the other hand, the values of calcium and magnesium are decreased in Group 2 and Group 3 (cases) when compared to Group 1(controls).

TABLE 3.2:

	p value (Gr.2/ Gr.1)	p value (Gr.3/ Gr.1)	p value (Gr.3/ Gr.2)	p value (Gr.2+3/ Gr.1)
Uric Acid	<0.001**	<0.001**	<0.001**	<0.001**
Calcium	<0.001**	<0.001**	<0.001**	<0.001**
Magnesium	<0.001**	<0.001**	0.018*	<0.001**
Urea	0.302n.s	0.023*	0.158n.s	0.056n.s
Creatinine	0.043*	0.007*	0.122n.s	0.010*

**statistically very significant, *significant, n.s not significant

4. DISCUSSION:

Several qualitative inferences can be drawn on the basis of the results in our present study. Elevated serum uric acid concentrations predict the development of hypertension[13]. One of the most commonly accepted explanations for increased serum uric acid in preeclampsia is secondary to reduced renal urate clearance because of renal dysfunction[14]**.** Recently, increased oxidative stress and formation of reactive oxygen species (ROS) have been proposed as another contributing source of hyperuricemia noted in preeclampsia apart from renal dysfunction[15]. The findings of present study correlate well with findings of previous studies of P Tejal et al. (2014), M Manjeera et al. (2012), S Sandip et al. (2012), G Bellomo et al. (2011) etc.

Changes in calcium and magnesium metabolism during pregnancy could be a potential cause of pre-eclampsia. Modification of plasma calcium concentration leads to the alteration of blood pressure. The lowering of serum calcium and the increase of cellular calcium can cause an elevation of blood pressure in preeclamptic women. The increase of cellular calcium concentration when serum calcium went lower led to constriction of smooth muscles in blood vessels and increase of vascular resistance[16]. The observed low levels of magnesium in women with preeclampsia could be due to decreased dietary intake, increased clearance by the kidneys, haemodilution due to expansion of the extracellular space and increased consumption of minerals by the growing foetus[17]. These together with lowered calcium levels play a role in the

development of hypertensive disorders in pregnancy. The findings of present study correlate well with findings of previous studies of H Vafaei et al. (2015), D V Kanagal et al. (2014), Moholkar et al. (2014), Adekanle et al. (2014) etc.

Elevated urea levels in our present study may be due to occurrence of microangiopathic haemolysis, which is related to the injury of endothelium in the group with pre- eclamptic changes. As a consequence, urea synthesis in liver would be increased. This coupled with the incapability of kidneys to excrete urea from blood with such a high concentration explains the cause[18]. Increased creatinine levels could be due to increased re-absorption and decreased excretion of creatinine in proximal tubules[7].

5. CONCLUSION:

The results of the present research provide valuable information and association between the measured biomarkers and preeclampsia. The findings suggest that hyperuricemia, hypocalcemia and hypomagnesaemia may have a role in its etiology and are indicators of preeclampsia. Urea and creatinine levels though elevated in preeclamptic women, remained within normal range hence are of no predictive value. However, further studies with large sample size are necessary.

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