



Original Article

Assessment of Serum Electrolytes Status in Preeclamptic Pregnant Women

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ABSTRACT

Preeclampsia is a pregnancy specific syndrome and one of the most common causes of maternal and foetal morbidity and mortality. It's exact etiology is not known, but it may be associated with alteration in electrolytes status. Aim of the study was to evaluate role of serum calcium, sodium, potassium and chloride in preeclampsia and to compare them with those in normal pregnancy. It was a comparative cross sectional study conducted at the Department of Biochemistry, Sylhet Women's Medical College Hospital from June 2019 to August 2019. Patients attending in the obstetrics and gynaecology outpatient department were invited to participate in the study. A total of 60 subjects were involved in the study. The study subject comprised of two groups. Thirty were preeclamptic women considered as group-I and 30 were normotensive pregnant women considered as group-II. Serum calcium, sodium, potassium and chloride were analyzed in two groups. The results showed that, serum calcium, potassium were significantly decreased ($P < 0.001$) and serum sodium, chloride were significantly increased ($P < 0.001$) in preeclamptics as compared to normal pregnant women. It may be concluded that, dietary restriction of sodium, a dietary supplementation of calcium and potassium in the form of milk, cheese, soybean products, leafy vegetables, etc. during pregnancy, could result in a reduction in the incidence of pregnancy induced hypertension.

Keywords: Calcium, Sodium, Potassium, Chloride, Preeclampsia.

[Jalalabad Med J 2020; 17(1): 06-09]

INTRODUCTION

Preeclampsia is known as pregnancy-induced hypertension (PIH) or toxemia which is one of the leading causes of foetal and maternal mortality and morbidity¹. It is defined as the triad of hypertension,

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proteinuria and oedema occurring after 20 weeks gestation². The most common medical causes of maternal death around the world are haemorrhage, obstructed labour, infection and hypertensive disorders related to pregnancy, such as preeclampsia and eclampsia which is contributing to 80%³. It is a universal problem and it complicates at least 5-7% of all the pregnancies⁴. In Bangladesh preeclampsia and eclampsia cause about 16% of maternal death⁵. Despite its prevalence and severity, the pathophysiology of this

multi-system disorder is still poorly understood⁶. The patho-physiological mechanism is characterized by a failure of the trophoblastic invasion of the spiral arteries, leading to mal adaptation of maternal spiral arterioles, which may be associated with an increased vascular resistance of the uterine artery and a decreased perfusion of the placenta⁷. Pregnancy is a unique state where sodium retention is occurred with an increase in total body sodium secondary to volume depletion and reduction in GFR. Though electrolytes contribute significantly in the functioning of the vascular smooth muscles and have been found to play an important role in etio-pathogenesis of hypertension⁸.

It has been postulated that fluctuations in maternal serum ions may be the precipitating cause of elevated blood pressures in preeclampsia^{9,10}. In developing countries, dietary deficiencies of calcium and magnesium have been established to have a role in blood pressure regulation in pregnant women with a consequent development of preeclampsia¹¹. Very recently, electrolyte imbalance is also gaining focus in the evolution of preeclampsia¹². The role of electrolytes in maintaining the normal vasculature and regulating the blood pressure is established by various researches¹³. Due to the possible important role of electrolytes in preeclampsia, we measured the serum electrolytes in preeclamptic patients and compared with normal pregnant women to see the alteration of serum electrolytes in normal pregnant and preeclamptic women.

MATERIALS AND METHODS

It was a comparative cross sectional study conducted at the Department of Biochemistry, Sylhet Women's Medical College Hospital from June 2019 to August 2019. Patients attending in the obstetrics and gynaecology outpatient department were invited to participate in the study. Informed written consent was obtained from all the subjects. Total 60 subjects were enrolled in the study and divided into two groups. Group-I was for preeclamptic women and group-II was for normotensive pregnant. Women having history of

multiple foetus's, hypertension, renal diseases, liver diseases, cardiovascular disease, severe anaemia, diabetes, systemic or endocrine disorders and other pre-existing medical conditions which might be able to alter the study parameters were excluded from the study. Five ml venous blood sample was collected under aseptic conditions. Specimens were processed at the laboratory within 2-3 hours of sampling to avoid delay and hence possible haemolysis as well as electrolyte leakage. The normal values of different parameters under standard conditions are: serum total calcium (Ca^{++}) 9-11mg/dl, serum sodium (Na^+) 135-145 mmol/l, serum potassium (K^+) 3.5-5 mmol/l, serum chloride (Cl^-) 95-105 mmol/l and serum bicarbonate (HCO_3^-) 24-28 mmol/l. Statistical analysis was done by using SPSS version 22. The results were expressed as Mean \pm SD. It was statistically evaluated by student's t test. $p < 0.05$ was considered as statistically significant.

RESULTS

A total of 60 pregnant women were recruited for the study. This consisted of 30 preeclamptics and 30 normotensive pregnant women. The clinical characteristics were shown in Table-I. There was no significant difference of age between two groups, a significant difference was observed in the blood pressure (BP) parameters. Table-II showed a significantly increased ($p < 0.001$) serum sodium levels in preeclamptics (150 ± 3.37) women compared to normotensive pregnant women (144.46 ± 6.96) mmol/l. There was a significantly reduced ($p < 0.001$) serum potassium levels in preeclamptic (3.16 ± 0.22) women mmol/L compared to normotensive pregnant women (3.73 ± 0.29) mmol/l. We also found significantly increased serum chloride (106.13 ± 7.27) in preeclamptics women compared to normotensive pregnant women (97.8 ± 4.86) mmol/l. There was no significant difference of bicarbonate between two groups. Serum calcium levels were significantly lower (8.24 ± 0.45) mmol/l in group-I ($p < 0.001$) in comparison with group-II (9.69 ± 0.62) mmol/l.

Table-I: Clinical characteristics of study subjects (n=60).

Parameters	Preeclamptic	Normal Pregnant	p-value
	Group-I Mean \pm SD	Group-II Mean \pm SD	
Age (Years)	30.97 \pm 5.51	29.93 \pm 2.60	0.358
Systolic blood pressure (mm of Hg)	147.6 \pm 5.85	121.67 \pm 6.13	<0.001
Diastolic blood pressure (mm of Hg)	97.8 \pm 6.39	69.00 \pm 6.62	<0.001

Table-II: Serum concentration of the electrolytes in the study subjects (n=60).

Parameters	Preeclamptic	Normal Pregnant	p-value
	Group-I Mean±SD	Group-II Mean±SD	
Sodium (mmol/l)	150±3.37	144.46±6.96	<0.001
Potassium (mmol/l)	3.16±0.22	3.73±0.29	<0.001
Chloride (mmol/l)	106.13±7.27	97.80±4.86	<0.001
Bicarbonate (mmol/l)	26.4±1.45	25.56±1.92	0.064
Calcium (mg/dl)	8.24±0.45	9.69±0.62	<0.001

DISCUSSION

Preeclampsia is a transient but potentially dangerous complication of pregnancy that affects 5-7% of pregnancies. It is a multifactorial process and multi-organ dysfunction with no individual factor strictly essential or sufficient for causing it. Thus, estimation of electrolytes in pre-eclampsia provides a very useful index for the study of physiological and pathological changes during pregnancy¹⁴. In the present study, there was significant increase in Na⁺ levels in preeclamptic patients compared to normal pregnant subjects. Hypertension observed in this group could be due to sodium retention though the retention was likely due to vasoconstriction leading to reduction of glomerular filtration rate and stimulation of renin-angiotensin-aldosterone mechanism. The net effect was decreased intracellular fluid and increased extracellular fluid volume⁸. Sodium retention, by means of the release of digitalis-like factor, and potassium deficit or hypokalaemia inhibited the sodium pump of arterial and arteriolar vascular smooth-muscle cells, thereby increasing the sodium concentration and decreasing the potassium concentration in the intracellular fluid. PIH is accompanied by amplification of the sodium retention and substantial alterations in intracellular water and electrolyte concentration. These changes are related to changes in cell membranes, which appears to be responsible for some pathological changes in preeclampsia¹⁵. Some of the best documented alterations involve changes in handling of sodium ion both on the systemic and intracellular levels¹⁶. Of the total body content of potassium in humans, 90% is sequestered inside the cell and sodium is predominantly located extracellularly. This preferable location of sodium and potassium depends on the active transport of the Na⁺/K⁺ ATPase or sodium potassium pump. Pregnancy induced hypertension may be an early sign of abnormality in the transport of sodium and potassium across the vascular smooth muscle cell

membrane, which is responsible for regulation of blood pressure¹⁷. Hyponatremia and hypokalaemia observed in a study on preeclamptic pregnant women of Saudi Arabia¹⁰ is in accordance with some other studies^{12,18}. Neeru Bhaskar et al. suggested the restriction of sodium could decrease the incidence of preeclampsia¹⁹. Our study was consistent with Kashyap et al.⁸, and Manjareeka et al.²⁰, who found that significantly lower serum calcium, potassium levels and higher sodium and chloride level. We also found a significant increase in chloride levels in preeclamptic women in comparison to normal pregnant women. Increase in chloride levels may probably be due to delay in excretion of sodium because of decreased renal blood flow²¹. Increased presence of serum chloride may result in increased osmolality leading to suppressed dilatation of vessels. Role of chloride in hypertension is not clearly understood. Anjum et al. also showed that serum calcium, potassium were significantly decreased (p<0.001) and serum sodium was significantly increased (p<0.001) in preeclamptics as compared to normal pregnant women²². Some study showed low serum calcium level in preeclamptic women compared to normal pregnant women^{12,16}. In our study statistically significant reduced levels of serum calcium were seen in Group I as compared to Group II. The findings are consistent with the reports of some researchers. Low serum calcium may cause high blood pressure by stimulating parathyroid hormone and renin release which in turn increases intracellular calcium in vascular smooth muscle. This causes vasoconstriction, increase of vascular resistance and rise in blood pressure in preeclamptic mother²³.

CONCLUSION

The present study concludes that in preeclamptic pregnant women, there is reduction in serum potassium, calcium and increase in sodium and chloride level. They may have an important causative role in

preeclampsia. Adjuvant supplementation of Ca^+ , K^+ with dietary restriction of sodium may minimize further progression of preeclampsia. Constant monitoring of serum Ca^+ , Na^+ , K^+ and chloride hence may reduce severity of manifestations and complications of preeclampsia.

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