Original Research Article

Correlation between Serum Sodium and Potassium levels in Preeclampsia

ABSTRACT

Aims: The aim of this study was to find the correlation between serum sodium and serum potassium with preeclampsia.
Study design: This is a cross sectional study.
Place and duration of study: Conducted in Department of Biochemistry in collaboration with the Department of Obstetrics and Gynaecology, (RIMS), Imphal (Manipur) from September 2016 to August 2018.
Methodology: Blood samples of 30 diagnosed patients of preeclampsia and above 18 years of age admitted in the obstetrics antenatal ward of RIMS, Imphal was taken. Samples were analysed for serum sodium and potassium by randox rx imola autoanalyser. The data were analyzed using statistical tools like Chi-square test through SPSS 21.0.
Results: Serum sodium levels were high in 63.34%of study group, low levels were seen in 3.33% followed by normal levels in 33.3%of study group. Serum potassium levels were low in 56.6%of study group, normal in 40% and high in 3.33% of study group. There was positive correlation between serum sodium and proteinuria which was statistically significant at P-value <0.01 and negative correlation was seen between serum potassium levels with proteinuria which was statistically significant at P-value 0.04.
Conclusion: In this study hypernatremia and hypokalaemia were associated with preeclampsia, and may have important causative role in this syndrome therefore constant monitoring of serum sodium and potassium level in pregnant women may help in early detection, management and prevention of preeclampsia.

Keyword: Preeclampsia, serum sodium, serum potassium, electrolytes

1. INTRODUCTION

Preeclampsia is a complex pregnancy disorder that has been associated with severe maternal, foetal and neonatal complications. It is characterized by increased peripheral blood pressure (BP), proteinuria, vasospasm, increased peripheral resistance and reduced organ perfusion [1]. It is diagnosed as BP of ≥ 140 mmHg systolic or ≥ 90 mmHg diastolic on two occasions atleast 4 hours apart after 20 weeks gestation in a woman with previously normal blood pressure and proteinuria (≥ 300 mg per 24 hours urine collection or ≥ +1 by dipstick method [2]. The worldwide prevalence is 9% and in India is 8-10% [3]. According to WHO, its incidence is seven times higher in developing countries (2.8% of live births) than in developed countries (0.4%of live births) [4].The exact etiology of preeclampsia is still unknown. The most widely accepted being the defective implantation characterized by incomplete invasion of the spiral arteriolar wall by extravillous trophoblasts resulting in a small calliber vessel with high resistance to flow [5].

Another etiopathogenensis proposed is the increase in both arterial and venous capacitance due to the abnormality in the transport of sodium and potassium across the vascular smooth muscle membrane [6]. The electrolytes like sodium and potassium contribute significantly in the functioning of the vascular smooth muscles and may play an important role in the pathogenesis of hypertension which is evident from the use of dietary sodium restriction as one of the prime treatments of high blood

pressure [7]. This study was taken up to see the correlation between serum sodium and serum potassium in preeclampsia with that of altered proteinuria and to figure out their role in its pathogenesis and prevention.

2. METHODOLOGY

The study was a cross sectional study conducted in the Department of Biochemistry in collaboration with the Department of Obstetrics and Gynaecology, Regional Institute of Medical Sciences & Hospital (RIMS), Imphal, Manipur for a period of 24 months from September 2016 to August 2018. The study population consisted of 30 patients diagnosed as preeclamptics and the patients were chosen from those admitted in the obstetrics antenatal ward of RIMS, Imphal. Patients considered were those aged 18yrs and above, who were diagnosed as preeclamptics admitted in obstetrics ward and who were willing to participate in the study.

2.1 Exclusion criterias: Chronic hypertension, diabetes mellitus, multiple pregnancies, renal diseases, gestational diabetes.

2.2 Procedure methodology: 5 ml of venous blood was collected, each in the fasting state by venipuncture from antecubital vein. The blood collected in the plain vial was centrifuged for 10 minutes within 30 minutes of collection and the serum was stored immediately at < -20 °C. Other investigation parameters were collected from the documentation of routine investigations done in the hospital. Serum sodium and potassium were measured by RANDOX Rx IMOLA autoanalyser using Ion selective electrodes method as described by Tietz NW [8]. Approval of Research Ethics Board, RIMS, Imphal was taken. Informed consent was taken from the participants before the study and confidentiality were maintained.

2.3 Statistical analysis: The collected data was analyzed using SPSS version 21 for windows. Descriptive statistics like mean, standard deviation were used. Chi square test was applied to correlate serum sodium and potassium with proteinuria. Chi-square test was used to ascertain the significance of differences between mean values. The level $P < 0.05$ was considered as the value for significance.

3. RESULTS

This study was carried out in the Department of Biochemistry in collaboration with the Department of Obstetrics and Gynaecology, Regional Institute of Medical Sciences, Imphal. The study included 30 diagnosed patients of preeclampsia above the age of 18 years. After thorough checking of the data, statistical analysis was done using SPSS version 21. The results and observations of the present study are being depicted as follows.

Figure 1 shows that 6 % of subjects aged 18-20years, 13% of subjects aged 21-25years, 16% of subjects aged 26-30years, 30% of subjects aged 31-35years and 33% of subjects aged more than 35years developed preeclampsia, depicting that the risk of developing preeclampsia increases with increasing age of pregnant woman.

Figure 2 shows that serum sodium levels were high in 63.34%of subjects, low levels were seen in 3.33% subjects followed by normal levels in 33.3% subjects. Depicting hypernatremia is seen in most subjects.

Figure 3 shows that serum potassium levels were low in 56.6% cases, normal in 40% cases and high in 3.33% cases. Depicting that hypokalaemia is seen most subjects.

In table 1 it was also noted that mean serum sodium was on the higher side at 145±14.87, mean potassium level was on the lower side at 2.97± 1.59 and mean level of proteinuria is 346.56 ± 101.64 which is on the higher side.

Table 2, shows that there was a positive correlation between serum sodium and proteinuria and the finding was statistically significant at P-value 0.00.

Table 3, shows that there was negative correlation between serum potassium levels with proteinuria which was statistically significant at P-value 0.04

Figure 1: Bar diagram showing age distribution of subjects with the prevalence of preeclampsia

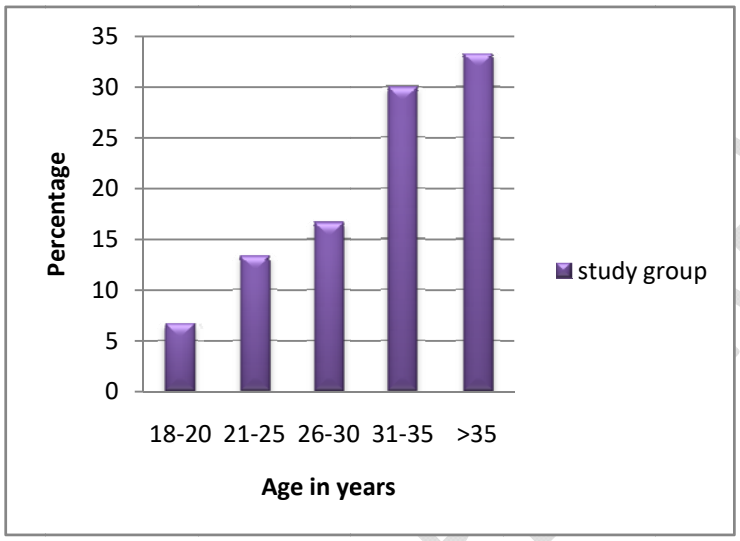

Figure 2: Pie chart showing distribution by serum sodium level in the subjects

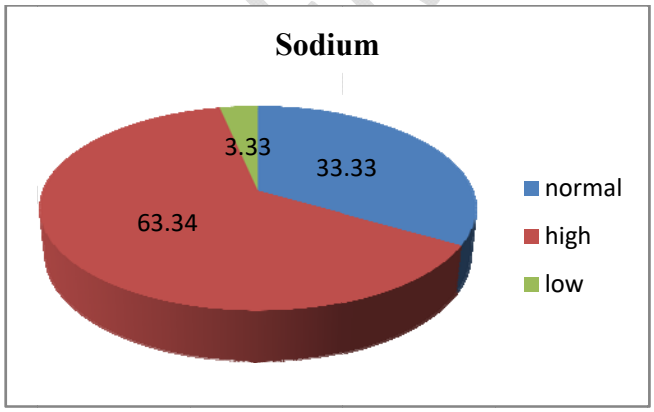

Figure 3: Pie chart showing distribution by serum potassium level in subjects

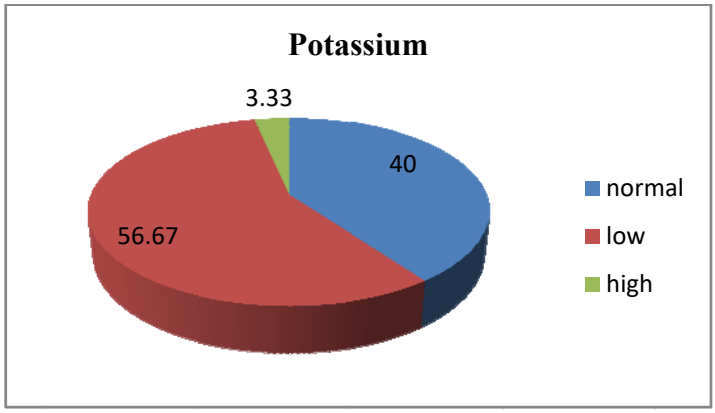

Table 1: Descriptive statistics of serum sodium, serum potassium and proteinuria

	(Mean ± SD)
Sodium	145.20 ± 14.87
Potassium	2.97 ± 1.59
Proteinuria	346.56 ± 101.64

Values are given in mean ± standard deviation

Table 2: Correlation between Proteinuria and serum sodium levels

		Number of patients with Proteinuria		P-value
Number of patients with Serum Sodium		< 300mg/day	>300mg/day	<0.01
	< 145 meq/l	9	1	
	>145meq/l	0	20	

*p < 0.05 is considered to be statistically significant

Table 3: Correlation between Proteinuria and serum potassium levels

		Number of patients with Proteinuria		P-value
Number of patients with Serum Potassium		< 300mg/day	>300mg/day	0.04
	<3.5 meq/l	4	20	
	>3.5 meq/l	5	1	

*p < 0.05 is considered to be statistically significant

4. DISCUSSION

Preeclampsia is a multifactorial process and multiorgan dysfunction with no individual factor to account for causing it [9]. Several studies have shown that electrolyte levels play significant roles in the etiopathogenesis of preeclampsia [10,11]. It 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 preeclampsia. Some of the best documented alterations involve changes in handling of sodium ion both on the systemic and intracellular levels [12].

This study showed that there was significant increase in Na+ levels and decrease in K+ levels in the preeclamptic study group and the results of this study conducted are in accordance to studies done by Tabassum H et al, which shows that hypernatremia and hypokalaemia may be caused by the release of digitalis-like factor on the sodium pump [13]. Na+/K+ ATPase, which is a cell surface enzyme, maintains the ion gradients between cells and the extracellular fluid (ECF). The extracellular domain of this enzyme contains a highly conserved binding site, a receptor for a plant derived family of compounds, the digitalis glycosides. The highly conserved nature of this enzyme and its digitalis receptor led to early suggestions that endogenous regulators might exist [14]. Normally potassium is predominantly located intracellularly

and sodium is located extracellularly and this is maintained by the active transport of Na+/K+ ATPase, the abnormality in this pump which is also responsible for regulation of blood pressure causes hypernatremia and hypokalaemia in the vascular smooth muscles which may precipitate pregnancy induced hypertension [15,16]. The increase in serum sodium leads to water retention, expansion of extracellular fluid and intravascular volumes which in turn increases venous return and elevates cardiac output. As this elevated blood flow continues to the tissues, it increases the peripheral resistance and eventually hypertension is developed [17]. The sodium retention which may also be due to vasoconstriction leads to reduction of glomerular filtration rate and in turn increase stimulation of renin angiotensin aldosterone system causing decreased intracellular fluid and increased extracelullar fluid volume leading to hypertension [9].

The decrease in K+ observed in our study group which was statistically significant is also supported with the findings of study done by Anjum et al [10]. In normal pregnancy hypokalaemic changes may be due to increased plasma levels of aldosterone and other mineralocorticoids [18] and the potassium deficit in body may be caused by inadequate conservation of potassium by kidney and alimentary canal, also faecal potassium losses can exceed even urinary losses [19]. Based on the findings of this study, hypernatremia and hypokalaemia which was observed may be a causative factor for preeclampsia.

5. CONCLUSION

In this study hypernatremia and hypokalaemia were associated with preeclamptic study group in Imphal, Manipur, showing that serum sodium and serum potassium may have important causative role in this disorder. The management of pregnancy induced hypertension has always been challenging despite numerous efforts therefore constant monitoring of serum sodium and potassium level in pregnant women may help in early detection, management and prevention of preeclampsia.

CONSENT

A written informed consent from all the patients was obtained after a complete explanation of the study.

ETHICAL APPROVAL

The study was approved by the Research Ethics Board, Regional Institute of Medical Sciences, Imphal.

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