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Determination of Serum Electrolyte Levels in Pregnant Women Observed With Preeclampsia during Pregnancy

Authors

Onochie Anthony[1], Ekwunoh Peter[1], Nwabufoh Onyeka[1], Ozuah Aloysius[2], Mamah Virginus[3]

[1]Department of Biochemistry, Anambra State University, Uli
[2]Department of Integrated Science Education, Nwafor Orizu College of Education, Nsugbe
[3]Department of Chemical Pathology, Nnamdi Azikiwe University Teaching Hospital, Nnewi

Corresponding Author

Dr. A.U. Onochie

Anambra State University, Uli, Nigeria

Email: *dronochie@gmail.com*

ABSTRACT

Aim: *To study the preeclampsia levels in pregnant women*

Setting and Design: *The cross sectional non randomized study.*

Materials and Methods: *A total of 100 pregnant women were recruited into the study. These were drawn from pregnant women attending their routine antenatal clinic at Nnamdi Azikiwe University Teaching Hospital, Nnewi, South East Nigeria. Blood samples were collected and analyzed for the following electrolyte parameters: Sodium, Potassium, Chloride and Bicarbonate using standard biochemical techniques for the laboratory investigations.*

Results: *It was observed that bicarbonate and potassium had a significant correlation with sodium at $P<0.05$ and $P<0.01$ respectively. There was also a significant correlation between potassium and bicarbonate at $P<0.01$. Sodium exhibited a significant correlation with chloride at $P<0.01$. Potassium showed a significant relationship with only the preeclamptic subjects' age ranges 41-45 only. Therefore, it will be of immense importance to conduct routine electrolyte check for expectant mothers especially during their third pre-trimester in order to avoid a situations where medical fit could arise either pre or post period of giving birth to new born babies.*

Key words: *Biochemical, Neonates, Preeclampsia, Serum electrolytes ,Stillbirth, obsteritics*

INTRODUCTION

The study was designed to reduce maternal mortality, unraveling biochemical underling which may precipitate this preeclampsia and also the prevalence of vertical transmission in neonates resulting to stillbirth. Obstetric emergency guidelines are drawn up to improve the consistency of management of pregnant women and their unborn children [1].

Preeclampsia is the most common hypertensive disorders which complicate pregnancy and lead to pre-term labour or delivery, considerably low birth weight infants and deaths up to 17.6% among pregnant women. The incidence of preeclampsia is in the range of 4 – 8 % of all pregnancies worldwide [2,3]Variations in incidence reflect, at least in part, differences in the maternal age distribution and proportion of primiparous women among population. [4]

Preeclampsia is a multi-system heterogeneous medical disorder characterized by hypertension (high blood pressure) and proteinuria (presence of protein in the urine) of a pregnant woman; often including edema (swelling or accumulation of water in the lower extremities) and occasionally involving thrombocytopenia (low platelets) or liver function abnormalities. If left untreated, it can develop into eclampsia, the life-threatening occurrence of seizures during pregnancy or in the first week after delivery in young women during a first pregnancy and also called gestational edema-proteinuria-hypertension (GEPH)[5]

Five percent of all patients with preeclampsia progress to eclampsia. Pre-eclampsia may develop from 20 weeks' gestation in a previously normotensive woman (it is considered early onset before 32 weeks, which is associated with an increased morbidity). Its progress differs among patients; most cases are diagnosed before labor typically would begin. Preeclampsia may also occur up to six weeks after delivery. Apart from Caesarean section and induction of labor (and therefore delivery of the placenta), there is no known cure. It is the most common of the dangerous pregnancy complications; it may affect both the mother and fetus [6].

Pregnancy is a period marked by profound charges in a woman's hormonal status and metabolism [7]. It is also a condition of chronic volume overload in which hypervolemia is the result of active sodium (Na^+) and water retention primarily induced by the activation of the rennin-angiotensin system[8]. The ability to regulate nutrient balance during this period is critical to the mother and the growing foetus[9].

It is well known fact that electrolytes play an important role in aetiopathogenesis of hypertension and Electrolytes like Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Sodium (Na^+), and Potassium (K^+) play important role in preeclampsia as they contribute significantly in the functioning of vascular smooth muscles[10]. Ca^{2+} plays a critical role in the function of vascular smooth muscles. Alternation of plasma Ca^{2+} concentration leads to raised blood pressure .Mg^{2+} act as co-factor for many enzymes (e.g. Sodium Potassium ATPase) and involved in peripheral vasodilation[10,11,12]. Consequently, blood Ca^{2+} and Mg^{2+} have a relaxant effect on the blood vessels of pregnant women[12,13].

Aim

1. To reduce maternal mortality due to preeclampsia
2. To check the prevalence of vertical transmission among the neonates which results in stillbirth

MATERIAL AND METHODS

This cross sectional non randomized study was conducted at the Department of Chemical Pathology, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State, Nigeria. A total of 100 pregnant women were recruited for the study amongst pregnant women attending their regular antenatal care. Oral consents were obtained before embarking on the study.

Methodology

Sample collection: About 5mls of blood were drawn from the pregnant women into Lithium heparium tubes. The blood was used for electrolyte analysis for the determination of sodium, potassium, chloride and bicarbonate levels.

Statistical Analysis

The data obtained from the study was statistically analyzed with the aid of SPSS-17 package. The results were segregated as shown in different tables and figures. The statistical significance of the research was recorded as $P \leq 0.05$ or $P \leq 0.01$ in the correlations analysis of the parameters studied. There is significant correlation seen in bicarbonate, potassium and chloride $P < 0.05$ and $P < 0.01$ and also no significant correlation within and between groups $P > 0.05$.

RESULT

A total of 100 preeclampsia subjects were recruited into the study. These were classified according to their different age ranges. These subjects were randomly picked among preeclampsia subjects. These subjects picked were 16 in number from 21-25 age ranges, 25 in number from 26-30 age ranges, 31 in number from 31-35 age ranges, 22 in number from 36-40 age ranges and 6 in number from 41-45 ranges.

The electrolyte parameters ran for them were the following sodium, potassium, chloride and bicarbonate.

The result of the study showed that bicarbonate and potassium had a significant correlation with sodium at $P<0.05$ and $P<0.01$ respectively. There was also a significant correlation between potassium and bicarbonate at $P<0.01$. Sodium exhibited a significant correlation with chloride at $P<0.01$.Finally, correlation existed between sodium and potassium against bicarbonate at $P<0.05$ and $P<0.01$ respectively. See table 1

There was no significant relationship between sodium and chloride concentration within the age ranges respectively while potassium showed a significant relationship with only the preeclamptic subjects age ranges 21-25, 26-30, 31-35, 36-40 and 41-45 respectively. See table 2.

In the study, there were no significant relationship in the various electrolyte parameters done for the preeclamptic subjects between groups and within groups of the various age ranges at $P<0.05$. See table 3.

Table 1: Correlation of Different Electrolyte Concentrations in Pregnant Women Suffering From Preeclampsia

		Na+ 134-145 (mmol/l)	K+ 3.5-5.5 (mmol/l)	Cl- 96-106 (mmol/l)	HCO_3^- 21-31 (mmol/l)
Na^+ (mmol/l)	Pearson Correlation	1	.017	.375**	.202*
	Sig.(2-tailed)		.867	.000	.044
	N	100	100	100	100
K^+ (mmol/l)	Pearson Correlation	.017	1	.038	-.275**
	Sig.(2-tailed)	.867		.707	.006
	N	100	100	100	100
Cl^- (mmol/l)	Pearson Correlation	.375**	.038	1	-.063
	Sig.(2-tailed)	.000	.707		.536
	N	100	100	100	100
HCO_3- (mmol/l)	Pearson Correlation	.202*	-.275**	-.063	1
	Sig.(2-tailed)	.044	.006	.536	
	N	100	100	100	100

* Significant

- ❖ Correlation is significant at the 0.05 level (2-tailed).
- ❖ Correlation is significant at the 0.01 level (2-tailed).

Table 2: Correlation of Concentration of Electrolytes with Different Age Ranges of Pregnant Women Suffering From Preeclampsia

Age range (years)		Na^+ (134-145mmol/l)	K^+ (3.5-5.5mmol/l)	Cl^- (96-106 mmol/l)	HCO_3^- (21-31mmol/l)
21 – 25	Mean	137.1875	3.5500	100.6875	19.0625
	Std. Deviation	4.50509	.70522	4.19076	3.73218
26 – 30	Mean	137.5200	3.7480	99.8800	19.4400
	Std. Deviation	4.41701	.83223	3.71169	3.05614
31 – 35	Mean	137.9355	3.6290	100.0645	19.2903
	Std. Deviation	3.74998	.64301	3.05435	2.86582

36 – 40	Mean	137.0000	3.5409	100.0455	18.2727
	Std. Deviation	5.30947	.71024	3.38733	3.07342
41 – 45	Mean	137.1667	3.3000	100.6667	19.8333
	Std. Deviation	4.49073	.40497	1.75119	.98319
Total	Mean	137.4600	3.6070	100.1500	19.1000
	Std. Deviation	4.38183	.70442	3.39154	3.02348

TABLE 3: Correlation between Levels Of Biochemical Parameters Anova

		Sum of Squares	df	Mean Square	F	Sig.
Na+(mmol/l)	Between Groups	13.458	4	3.365	.169	.954
	Within Groups	1887.382	95	19.867		
	Total	1900.840	99			
K+ (mmol/l)	Between Groups	1.226	4	.306	.608	.658
	Within Groups	47.899	95	.504		
	Total	49.125	99			
Cl- (mmol/l)	Between Groups	8.514	4	2.128	.179	.949
	Within Groups	1130.236	95	11.897		
	Total	1138.750	99			
HCO3- (mmol/l)	Between Groups	22.318	4	5.580	.601	.663
	Within Groups	882.682	95	9.291		
	Total	905.000	99			

DISCUSSION

Preeclampsia has been labelled as a dreaded disease affecting women and their pregnancy right from ancient times. The numerous complications associated with it have triggered a phobia in pregnant women and aroused the interest to medical personnels everywhere. There is no individual factor strictly essential or sufficient for causing it. Although electrolyte levels play significant roles in the etiopathogenesis of hypertension in pregnant women, the observed results from the findings of the research work showed that there was no significant relationship between sodium and chloride concentrations within the age ranges. This could be attributed to the fact that Na^+ and Cl^- may be responsible as the causative agent for preeclampsia in sufferers generally. Our findings is not in consonance with the various authors that reported that the pattern of levels of serum sodium and chloride found to be significantly increased in patients of preeclampsia from northern part of India when compared with the normal pregnant women,[10]

Hypokalaemia in patients of preeclampsia of age range from 41-45 was observed as compared to pregnant women who never exhibited preeclampsia fit. Hypokalaemia changes in normal pregnancy may be due to increased plasma

levels of aldosterone and other mineralocorticoids. The total body content of potassium in humans was to be in the intracellular compartment showed that 90% is sequestered inside the cell and sodium is predominantly located in the extra cellular compartment. This preferable location of sodium and potassium depends on the active transport of the Na+/K+ ATPase [14]. Pregnancy induced hypertension may be due to abnormality in the transport of Na+ and K+ across the vascular smooth muscle cell membrane, which is normally responsible for the maintenance of blood pressure [10]. Potassium deficit in body is as a result of inadequate conservation of potassium by kidneys and alimentary canal, faecal and potassium losses can exceed even urinary losses [15]

The research work showed that there was significant reduction in bicarbonate concentration in the patients suffering from preeclampsia. This is possible due to the fact women of child bearing ages in the tropics are in very different location and are lined to different physical activities and orientation but it was reported that there was increase in the serum HCO_3^- in preeclamptic subjects which could be a decrease pCO_2 leading to suppression of vasodilation[16] whereas other reported there are changes in the two stages of pregnancy first and second trimesters where there is increase in level of bicarbonate tends towards alkalinity which can be normalized by the last stage of pregnancy.

Generally, it has adduced that pregnancy induces physiologic changes which coupled with emotional stress and challenges that contribute to changes in biochemical status of pregnant women especially electrolyte imbalance such that hypokalemia is associated with preeclampsia and may have an important causative role in preeclampsia. Potassium ion with dietary restriction of sodium may minimize further progression of preeclampsia. Thus, it will be of immense importance to conduct routine electrolyte check for expectant mothers especially during their third pre trimester in order to avoid a situation where medical fit could arise either pre or post period of giving birth to new born babies.

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