Research Article

Evaluation of Serum Electrolytes in Type II Diabetes Mellitus

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ABSTRACT

Diabetes Mellitus (DM) is a metabolic disease which is of great concern worldwide. Apart from other factors, the underlying mechanism pertaining to the electrolyte imbalance has to be explored. Hence it was proposed to study the levels of serum sodium, potassium and chloride in type II DM patients. 50 confirmed type II DM patients and 50 age and sex matched controls were chosen for the study. Serum levels of sodium, potassium and chloride were measured. Statistical analysis was performed using Students 't' test. Results showed significantly elevated sodium (hypernatremia), mild elevation of potassium (hyperkalemia) and chloride (hyperchloridemia). These aberrations could be due to the hypertonicity of blood and redistribution of water and electrolytes noticed in DM. It may be concluded from this study that dysregulation of glucose homeostasis may lead to electrolyte imbalance due to increase in sodium & potassium chloride levels.

Keywords: Fasting Blood Sugar(FBS), Diabetes Mellitus (DM), Sodium, Potassium, Chloride.

INTRODUCTION

The prevalence of DM is of great concern world wide and 20% to 50% of new-onset type II DM is observed in young generation[1].

Electrolyte imbalance is common in patients with diabetes, which could be the result of an altered distribution of electrolytes.

And it is related to hyperglycemia induced osmotic fluid shifts or of total-body deficits brought about by osmotic diuresis[2].

The insulin mediated glucose intake is impaired, but the potassium intake of cells remains normal.

Hyperkalemia occurs due to increase in plasma tonicity that results from the redistribution of potassium from intercellular space to extracellular space in patients with type II DM.

Diabetes mellitus produces dysnatremias via several underlying mechanisms.[3-4]

Glucose is one of the osmotically active substance. In hyperglycemia this will increase osmolality of the serum, which results in movement of water out of the cells.

Uncontrolled DM also induce hypovolumic hyponatremia due to osmotic diuresis. Moreover in diabetes ketoacidosis, the urinary electrolyte loss aggravates the renal sodium wasting[5-6].

There are contradictory reports regarding the prevalence of electrolyte disturbances among patients with type II DM[7-9]. Hence the study was designed to assess the serum electrolytes in type II DM.

The aim of this study is to measure the serum Sodium, Potassium and chloride levels in type II DM patients.

MATERIALS AND METHODS

The study comprised of 50 confirmed type II DM patients from Shri Sathya Sai Medical College and Hospital.

50 age and sex matched healthy individuals were treated as controls**.**

Inclusion Criteria

- Patients with type II DM were included

Exclusion Criteria

- The subjects with metabolic syndrome
- Patients with thyroid dysfunction
- Blood samples were collected from the controls and the patients. Serum Sodium, Potassium and chloride levels were analyzed using electrolyte analyzer.

Biochemical Measurements

- Estimation of Blood glucose was done by GOD-POD method[10] using semi-auto analyzer
- Serum electrolytes were measured by using FLEA method using electrolyte analyser

Statistical analysis were performed by using Student's't' test,and Pearson's correlation was used to compare FBS and electrolytes.

RESULTS

In this study, 100 subjects were included in which 50 were diabetic and 50 were age matched healthy controls.

Table 1 shows the biochemical measurements which includes HbA1c, FBS, Sodium, potassium and chloride levels in both diabetic and control groups in which HbA1c was significantly (P <0.05) elevated in the diabetic

patients when compared with the non diabetic healthy controls. In diabetic patients sodium levels were found to be high compared with controls and it is statistically significant (P<0.05). It was observed that the potassium and chloride levels were slightly elevated when compared with controls.

Table 2 **s**hows the correlation of FBS with the electrolytes in which sodium was positively correlated. P* and r * values were found to be (P* 0.017 and r * -0.233) which is statistically significant. FBS was correlated positively with potassium. The P* and r * values were found to be (P* >0.05 and r * 0.016) and it shows significance. FBS was correlated positively with chloride and P* and r* value was found to be (P*0.04 and r *0.21) it was also found to be statistically significant.

Table 1: Biochemical Measurements in Type II DM

Parameters	Diabetes (50)	Controls (50)	P * Value
HbA1C (%)	8.8 ± 1.9	4.5 ± 0.4	<0.05
FBS (mg/dl)	186 ± 12	108 ± 13	<0.05
Sodium (meq/l)	162.6 ± 8.5	138 ± 3.3	<0.05
Potassium (meq/l)	5.40 ± 0.65	4.16 ± 0.82	<0.05
Chloride (meq/l)	116 ± 5.5	99.7 ± 0.04	<0.05

P * value < 0.05 then it is considered to be statistically significant

Table 2: Correlation of FBS with the Electrolytes in Type II DM

Electrolytes		r * value	P * value
Sodium(Na^+)	FBS	-0.233	0.017
Potassium (K^+)		0.016	>0.05
Chloride (Cl^-)		0.21	0.04

P* value < 0.05 then it is considered to be statistically significant

DISCUSSION

The association between blood glucose and serum electrolytes is multi factorial in which it is related to a number of other factors, which includes age and associated conditions.

Increased urination leads to loss of electrolytes and water and results in the imbalance which disturbs sodium and potassium levels in the body. Studies suggest that uncontrolled DM can also induce hypovolemic-hyponatremia due to osmotic diuresis.

Furthermore in diabetic ketoacidosis, urinary electrolyte loss magnify the renal sodium wasting[11-12]. In the present study it was found that sodium levels in diabetes patients was found to be high when compared with controls and sodium was correlated negatively with glucose and it was found to be statistically significant.

Increased or normal plasma sodium concentrations in the presence of hyperglycemia indicate a clinically significant deficit in total body water.

Poorly controlled DM was implicated in the development of hypernatremia in few cases. Consequently, in patients with uncontrolled DM, serum concentration of [Na+] is variable, reflecting the balance between the hyperglycemia-induced water movement out of the cells that lowers [Na+], and the glucosuria-induced osmotic diuresis, which tends to raise [Na+].

Thus, hypernatremia and hyperosmolarity may be considered as contributing factors to the occurrence of DM[13].

Present study shows that the DM patients were more prone to miild hyperkalemia, when compared to the healthy controls. Some of the studies have shown that the exogenous insulin can induce mild hyperkalemia because it promotes the potassium influx into the skeletal muscles and hepatic cells which increases the activity of Na^+ and K^+ ATP ase pump.

Hyperkalemia is also associated with impaired insulin secretion and decreased peripheral glucose utilization which results in carbohydrate intolerance and hyperglycemia[14].

Elevated serum Cl-levels were found in diabetes patients and this might be due to diabetic ketoacidosis. Ketoacidosis cause reduction in blood pH which further disturbs acid base balance and leads to the elevation of chloride.

SUMMARY AND CONCLUSION

To sum up, 50 patients with type II DM and 50 healthy controls were screened for electrolyte levels. From the above studies it was observed that the dysregulation of glucose homeostasis which may alter due to increase in sodium, potassium and chloride levels. It may be concluded that in type II DM, assessment of electrolytes

related abnormalities are important to monitor the prognosis of type II DM patients.

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