

Original Research Article

Evaluation of Electrolytes Level Imbalance as a Risk Factor for Chronic Complications in Diabetic Patients

Dr. A.Valarmathi¹, Dr. Lalbahadur Sastri²

¹Reader, Department of Physiology Raja Muthaiah Medical College, Annamalai University, Chidambaram -608001

²Senior Consultant, Department of Biochemistry, Varma hospital, Cuddalore District

***Corresponding author**

Dr. A. Valarmathi

Email: dr.avalarmathi6a@gmail.com

Abstract: Diabetic patients frequently develop a constellation of electrolyte disorders. These disturbances are particularly common in decompensated diabetics, especially in the context of diabetic ketoacidosis or nonketotic hyperglycaemic hyperosmolar syndrome. These patients are markedly potassium-, magnesium- and phosphate-depleted. Diabetes mellitus (DM) is linked to both hypo- and hyper-natremia reflecting the coexistence of hyperglycaemia-related mechanisms, which tend to change serum sodium to opposite directions. The aim of this study is to measure the serum electrolytes levels in type II DM patients. Thirty diabetic patients with stable glycaemic control and without intercurrent illness or severe diabetic complications were studied on the occasion of a regular follow-up after informed consent was obtained. Thirty non diabetic patients with healthy glucose levels served as controls. Fasting blood samples were collected from control and diabetic subjects in lithium heparin coated tubes. A portion of blood was collected to obtain serum. The electrolytes levels were analysed. The fasting glucose level were significantly ($p<0.001$) higher among the DM compared to the controls. The Sodium and Chloride levels were also significantly ($p<0.001$, respectively) higher in DM when compared to the healthy controls. Magnesium level was found to be reduced which is significant ($p<0.32$, respectively) On the other hand, the Potassium levels were elevated significantly ($p<0.001$, respectively) different among patients and controls. Electrolytes play an important role in controlling the fluid levels, acid base balance, and regulation of neurological and myocardial functions, oxygen delivery and many other biological processes. Patients with Diabetes mellitus are more prone to develop electrolyte imbalances probably due to the complications they develop and the medications they receive.

Keywords: Diabetes mellitus, electrolyte imbalance, Neurological and cardiac manifestation.

INTRODUCTION

Diabetes mellitus (DM) is characterized by chronic hyperglycaemia which results from defective insulin action and secretion [1]. High glucose levels may cause eye, kidney, and nerve complications and it is an increased risk for cardiovascular disease. The complications of diabetes are metabolic imbalance, blood vessel degeneration, effect on electrolyte concentration and offset the proportion of electrolytes. Electrolytes play an important role in maintaining acid-base balance, blood clotting, control body fluid and muscle contractions [2]. The disturbed electrolyte distribution may affect the course of diabetes and its management. The relation between blood glucose and electrolytes is complex and is related to number of other

factors like age and associated conditions. Several scientists have estimated the electrolytes levels in diabetes mellitus in several countries and showed the association between electrolytes levels and diabetes [3]. The study was conducted to investigate the electrolytes disturbance in type 2 diabetes mellitus. Diabetic nephropathy is one of the complications of diabetes mellitus, which ultimately leads to renal failure, which is also a cause of electrolyte imbalance in diabetic patients [4]. Diabetes mellitus was identified as an independent risk factor for hyponatremia and hypomagnesaemia. Various pathophysiological factors like; nutritional status, coexistent acid-base imbalance, certain drugs, other comorbid diseases like renal disease

or acute illness, alone or in combination, also play a key role in electrolyte imbalance [5].

MATERIALS AND METHODS

Study group comprised 60 subjects between 35 to 70 years who were visiting hospital OPD, as well as admitted will be considered. The control group included 30 normal healthy subjects visiting hospital for routine check-up without any history of, hypertension, diabetes, alcoholism and smoking. Under aseptic conditions about 5 ml of venous blood was drawn and collected in plain vacutainer, after taking informed consent. Serum was separated by centrifugation at 3000 rpm for 10

minutes at room temperature and the following parameters were estimated. Fasting glucose, Serum sodium, potassium and chloride, magnesium were determined by direct ion selective electrode methods by using AVL 9180 electrolyte analyser.

Statistical analysis

Results are presented as mean + SD. Statistical significance and difference from control and test values evaluated by Student’s t-test

RESULTS

Table-1: Shows the Fasting Blood Glucose and Electrolyte Variations among Type 2 Diabetes Mellitus Patients and Controls

Parameters	Type II Diabetes (n=30)	Control (n=30)	P value
1.Glucose (mmol/L)	148.8 ± 0.2	76.0 ± 0.1	0.001
2.Na+(mmol/L)	165.4 ± 1.1	133.2 ± 0.5	0.001
3.K+(mmol/L)	5.65 ± 0.1	3.82 ± 0.1	0.001
4. Cl-(mmol/L)	119.3 ± 1.3	94.6 ± 0.5	0.001
5.Magnesium (mg/dl)	1.34 + 0.89	1.99 + 0.92	0.32

Statistically significant differences among patients and controls are indicated along with their significant values. As shown in Table-1 the fasting glucose level were significantly (p<0.001) higher among the DM compared to the controls. The Sodium and Chlorine levels were also significantly (p<0.001, respectively) higher in DM when compared to the healthy controls. Magnesium level was found to be reduced which is significant (p<0.32, respectively) On the other hand, the Potassium levels were elevated significantly (p<0.001, respectively) different among patients and controls.

DISCUSSION

Electrolyte disorders are commonly encountered in a broad spectrum of patients (from asymptomatic to critically ill) in hospital population to community subjects. Electrolyte derangements are usually multifactorial and many pathophysiological conditions [6]. Coexistent acid-base abnormalities, Drug intake, nutritional status, gastrointestinal absorption, associated renal disease or acute illness, play a key role [7]. Diabetes Mellitus, a common metabolic disorder associated with these pathophysiological conditions often present with a diversity of electrolyte derangements. Uncontrolled Diabetes mellitus may be associated with impaired

renal function [8]. Many Studies reported a wide variety of electrolyte disorders in diabetes mellitus documented increased proportion of hyperkalaemia in this study. The probable explanations could be: the increased incidence of hyperkalaemia in diabetic patients than healthy individuals reduced glomerular filtration of K+ (due to acute kidney injury and chronic kidney disease) and many drugs i.e. potassium-sparing diuretics, angiotensin-converting enzyme inhibitors and beta blockers that interfere with K+ excretion [9]. Magnesium, the second most abundant intracellular cation involved in a number of important biochemical reactions, including all ATP-transfer reactions. Possibly because of its relevance to all protein kinases, magnesium appears to mediate hormonal as well as other aspects of cellular glucose utilization [10]. There was significant decreased level of magnesium found in diabetic patients in the present study as described by various previous workers [11]. 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 glycosuria-induced osmotic diuresis, which tends to raise [Na+] [12]. Elevated serum Chlorine 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. Al-Jameil showed increased levels of Chlorine in diabetes mellitus compared to control. In our present study, we have found increased level of Chlorine in diabetes mellitus [13].

CONCLUSION

In conclusion, present study showed that serum electrolytes were significantly increased in diabetes mellitus [14]. As electrolytes imbalance is correlated with various chronic diseases electrolytes measurement is essential in diabetes mellitus to decrease the risks. Treatment of electrolytes imbalance in diabetes mellitus should include by the physician. However, our study has a small sample size resulting in low power to detect minor to modest associations, therefore further study with large sample size is required [15].

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