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COMPARISON OF ELECTROLYTES IN DIABETIC AND NON-DIABETIC PATIENTS

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Abstract

Introduction: Characterized by high blood glucose levels referred as hyperglycemia, diabetes mellitus (DM) is a metabolic disorder with changes in carbohydrates, protein and lipid metabolism which is caused due to disturbance in secretion of insulin or insulin action or both. There are several effects of diabetes, beginning with metabolic imbalances, degeneration of the walls of the blood vessels that can allow electrolyte concentrations to dilute and counteract the proportion of electrolytes. In several applications, electrolytes play an important part, such as acid base, body fluids, blood clots and muscle contractions are regulated. In preserving homeostasis in the body, and also in protecting cellular structure, tissue perfusion and acid base equilibrium, fluid and electrolyte equilibrium play important roles. The association with glucose in the blood and electrolytes are complex and electrolyte imbalances can influence the course and treatment of diabetes. We know that diabetes is a chronic disease and there are possible complications. For a long time people with extreme hyperglycemia may remain mostly asymptomatic. Consequently, many of them have some end-organ damage at the moment of diagnosis of diabetes. Pathophysiological factors like nutritional status, certain drugs, coexistence of acid-base imbalance, co-morbid conditions like renal disorder or acute illness play a key role in electrolyte imbalance, alone or in combination.

Material & Methods: Patients attending medicine OPD were selected for this study after obtaining their consent. Purposive sampling technique has been used to obtain sample. A total of 100 patients were included in this comparative study among which 50 were diabetic and 50 were non-diabetic patients. The demographic details of patients were noted. Blood samples were collected and investigated and analyzed for Magnesium, Sodium, Chloride and Potassium. RESULTS: In present study it has been observed that the levels of magnesium were 1.7 ± 0.4 in diabetic patients and 2.0 ± 0.2 in patients not suffering from diabetes. It was observed that the mean values of magnesium in diabetic patients were significantly lower compared to those of patients who did not suffer with diabetes. Sodium, chloride and potassium did not differ significantly among both groups.

Conclusion: Importance of serum electrolytes is shown in this study. Diabetes mellitus patients are more likely to develop electrolytes. Most likely, imbalances are due to the complications they acquire and the medicines they take. Hypomagnesemia is more common in our sample than other electrolyte disorders in the diabetic population.

Keywords: Electrolytes, Magnesium, Diabetes Mellitus

Introduction

Characterized by high blood glucose levels referred as hyperglycemia, diabetes mellitus (DM) is a metabolic disorder with changes in carbohydrates, protein and lipid metabolism which is caused due to disturbance in secretion of insulin or insulin action or both. This disorder emerges when the insulin-producing β-cells have been impaired. If the body loses insulin, it may contribute to diminished glucose delivery across cell membranes, resulting in cells needing food, thereby increasing the body's fat metabolism[1]. The most prevalent endocrine disease observed in medicine is diabetes mellitus. The prevalence of diabetes is increasingly growing and developing into an epidemic. Over the last two decades, the worldwide prevalence of diabetes mellitus has grown significantly, from an estimated 30 million cases in 1985 to 177 million cases in 2000. More than 360 million people will have diabetes by the year 2030, based on existing patterns[2]. India now has over 50 million people with type 2 diabetes and is called the world's "diabetic capital." The International Diabetes Federation (IDF) reports that the overall number of individuals with diabetes in India is

about 40.9 million, and this is projected to increase higher to 69.9 million by 2025[3,4].

There are several effects of diabetes, beginning with metabolic imbalances, degeneration of the walls of the blood vessels that can allow electrolyte concentrations to dilute and counteract the proportion of electrolytes. In several applications, electrolytes play an important part, such as acid base, body fluids, blood clots and muscle contractions are regulated. In preserving homeostasis in the body, and also in protecting cellular structure, tissue perfusion and acid base equilibrium, fluid and electrolyte equilibrium play important roles. The association with glucose in the blood and electrolytes are complex and electrolyte imbalances can influence the course and treatment of diabetes[5]. In community subjects, electrolyte homeostasis disruptions are also commonly observed. Community-acquired electrolyte disorders are associated to poor prognosis, including chronic and moderate. Among the diseases with elevated incidence of electrolyte defects, diabetes mellitus (DM) is included because the aforementioned causes (particularly impaired renal function, malabsorption syndromes, acid-base disorders and multidrug regimens) are frequently present in diabetics[6,7].

Pathophysiological factors like nutritional status, certain drugs, coexistence of acid-base imbalance, co-morbid conditions like renal disorder or acute illness play a key role in electrolyte imbalance, alone or in combination[8].

We know that diabetes is a chronic disease and there are possible complications. For a long time people with extreme hyperglycemia may remain mostly asymptomatic. Consequently, many of them have some end-organ damage at the moment of diagnosis of diabetes. The enormous influence of diabetes on morbidity and early mortality in Western and developing countries therefore highlights the importance of closely examining all possible factors about pathogenesis[9,10]. Therefore this study is undertaken with an objective to compare the imbalance of electrolytes among diabetic as well as non diabetic patients.

Material & Methods:

The present study was undertaken at Venkateshwara Institute of Medical Sciences, Gajraula, U.P. India. Patients attending medicine OPD were selected for this study after obtaining their consent. Purposive sampling technique has been used to obtain sample. A total of 100 patients were included in this comparative study among which 50 were diabetic and 50 were non-diabetic patients. The demographic details of patients were noted. Blood samples were collected and investigated and analyzed for Magnesium, Sodium, Chloride and Potassium. The data was entered in Microsoft Excel 2013 and analyzed using SPSS version 20. Descriptive statistics were used for representation of qualitative data. An unpaired t-test was used for quantitative comparison.

Results:

Table 1: Demographic data

Gender	Diabetic	Non-diabetic	**Total**
Male	31 (62%)	27 (54%)	58
Female	19 (38%)	23 (46%)	42
Total	50	50	100

It was observed that overall there were 58 (58%) males and 42 (42%) females in present study. There were 50 patients in each group of diabetic and non-diabetic patients respectively. Among 50 diabetic patients 31 (62%) were males and 19 (38%) were females while amongst on-diabetic patients, 27 (54%) were male and 23 (46%) were females. It is seen that proportion of males was more compared to females in diabetic group of patients.

Table 2: Levels of electrolyte among diabetic and non-diabetic patients

	Diabetic	Non-diabetic	P-value
Magnesium (mg/dl)	1.7 ± 0.4	2.0 ± 0.2	<0.05
Sodium(mmol/l)	140 ± 4.2	143 ± 3.7	0.22
Chloride(mmol/l)	105 ± 4.5	107 ± 3.9	0.65
Potassium(mmol/l)	4.1 ± 0.3	3.8 ± 0.4	0.31

It was observed that the mean values of magnesium in diabetic patients were significantly lower compared to those of patients who did not suffer with diabetes. Sodium, chloride and potassium did not differ significantly among both groups.

Discussion:

For patients with type 2 diabetes mellitus, electrolyte imbalance is usually present. The cause is typically multifactorial, but in diabetic ketoacidosis and hyperglycemia, it usually results from insulin deficiency[11]. Water and electrolyte balance derangements may occur in DM subjects due to insulin deficiency, hyperglycemia and hyperketonemia[12]. In present study it has been observed that the levels of magnesium were 1.7 ± 0.4 in diabetic patients and 2.0 ± 0.2 in patients not suffering from diabetes. It was found that the magnesium levels in present study were significantly lower in patients with diabetes in comparison with those who were non-diabetic patients. The results in a study conducted by Rao YS etal. and another study conducted by Deepti GN et. al. are in agreement with the results in present study[13,14]. Magnesium deficiency can play a role in the development and modification of endothelial dysfunction and altered role of Insulin. Ma et. al. found that the serum magnesium level in subjects with prevalent CVD and diabetes was significantly lower in African-Americans and Caucasians[15].

The explanations for the high prevalence of diabetes-related magnesium deficiency are not clear, but may include increased urinary loss, lower dietary intake or decreased magnesium absorption compared with healthy individuals. Several studies have shown an increase excretion of urinary magnesium in type 1 and type 2 diabetes mellitus[16,17]. Hypomagnesemia is stated to be both a source of poor glycemic control and a consequence of it. In both glucose transport mechanisms of the cell, magnesium is a cofactor of the membrane and various enzymes that are essential in oxidising carbohydrates[18]. The different causes of low magnesium in diabetics include low dietary intake, irregular transport of intracellular magnesium, increased renal excretion due to osmotic diuresis, loop use and diuretic thiazide or decreased renal tubular dysfunction due to insulin resistance[19,20]. In diabetic populations, hypomagnesemia is associated with an increased risk or development of retinopathy. Epidemiological evidence from data indicate that low magnesium intake populations are at elevated risk for hypertension, stroke, and other atherosclerotic disease manifestations[21]. Nagase N reported serum magnesium levels in diabetes mellitus (1.90±0.37) were substantially less than that of (2.30±0.32) in normal controls. They also concluded that in poorly controlled diabetic patients, serum magnesium levels are lower than those in well controlled diabetic patients. These findings indicate that magnesium deficiency is one of the causes of insulin resistance[22].

Conclusion:

Importance of serum electrolytes is shown in this study. Diabetes mellitus patients are more likely to develop electrolytes. Most likely, imbalances are due to the complications they acquire and the medicines they take. Hypomagnesemia is more common in our sample than other electrolyte disorders in the diabetic population. In the treatment of diabetic patients, hypomagnesemia as well as other electrolyte imbalances must be considered because timely diagnosis of them will have a potential effect on the risk of many diseases being acquired.

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