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Original Research Article

ASSESSMENT OF DYSLIPIDEMIA AND SERUM ELECTROLYTE DISTURBANCES IN CASES OF TYPE 2 DIABETES MELLITUS

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Abstract

Background: High glucose levels are a hallmark of a group of illnesses known as diabetes mellitus type 2. Electrolyte abnormalities are frequently seen in people with type 2 chronic diabetes. These individuals often have depleted levels of potassium, magnesium, and phosphate. The purpose of this study was to look at the lipid and electrolyte abnormalities in patients with chronic type 2 diabetes mellitus who were receiving care at the Rajiv Gandhi Institute of Medical Sciences and Hospital Adilabad.

Methods: The Rajiv Gandhi Institute of Medical Sciences [RIMS], Adilabad's Department of General Medicine and Biochemistry was where this study was carried out. Male and female participants with type 2 chronic diabetes mellitus were included in the study. Chronic diabetics were individuals who had been diagnosed with type 2 diabetes mellitus and had been taking medication for five years or more; they were referred to as Group I. In Group II, controls of similar age and sex were drawn from the general community. Fasting blood samples will be taken in a Vacutainer 10ml, and a completely automatic chemical analyzer called the "Beckman Coulter Au 400" will estimate the serum fasting blood sugar, serum electrolytes, and lipid profile. Statistical software was used to record and evaluate the data.

Results: There were two groups made up of 100 patients in total for the trial. Diabetes Group I and Group II (controls). When the serum fasting blood glucose levels were examined, group I had mean values of 174.5 25.6 mg/dl, and group II had mean values of 96.5 20.5 mg/dl; both groups had significant p values. The triglyceride levels were significantly different between groups I and II when compared to controls, with the group I's mean values being 201.55 35.8 mg/dl and group II's being 190.5 30.12 mg/dl. As opposed to group II, group I (diabetes) had higher potassium levels, and the p values were shown to be significant.

Conclusion: Patients with type 2 diabetes have an improper lipid and electrolyte balance, it may be said. Enzymatic activity, hormone production, and antioxidant levels can all be affected by altered mineral metabolism. As a result, monitoring these individuals every three months will aid in reducing the development of long-term diabetes-related problems.

Keywords: Dyslipidemia, Type 2 Diabetes, Electrolyte Disturbances

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Introduction

Insulin resistance and pancreatic beta islet cell loss define Diabetes Mellitus Type 2 (T2DM), a chronic and progressive metabolic condition. Hyperglycemia, which can result from either a partial or complete absence of insulin activity, or both, is typically a feature of diabetes mellitus [1]. Diabetes mellitus is one of the most common diseases in the globe and its frequency has been rising recently. One of the major sources of financial strain on the nation's healthcare system is diabetes and its consequences. It is estimated that 30 million individuals in India now have diabetes [2]. Impaired insulin secretion, increased hepatic glucose synthesis, and reduced insulin-stimulated glucose absorption in peripheral tissues are the three particular abnormalities observed in diabetes mellitus. Electrolytes are crucial for maintaining the proper acid-base balance, blood coagulation, bodily fluid regulation, and muscle contractions. The progression of diabetes and its therapy may be impacted by disturbed electrolyte distribution [3]. Electrolytes and blood glucose have a complicated relationship that depends on a variety of other variables, including age and underlying medical problems [4]. Due to the osmotically active nature of glucose, hyperglycemia raises serum osmolality, which causes water to flow out of cells and lower sodium levels due to the dilutional effect. The osmotic impact of glucose also results in osmotic diuresis, which reduces the amount of blood in circulation and induces cellular dehydration by shifting water from intracellular regions. Additionally, people with diabetes experience lipid abnormalities and are more likely to develop atherosclerosis, which is the main factor in both type 1 and type 2 diabetic patients' premature deaths [5-7]. Coronary artery disease is strongly predicted by hypertriglyceridemia, obesity, hyperinsulinemia, hypertension, and poor glucose tolerance. Considering the above, the current study's goal was to examine the electrolytes and lipid abnormalities in patients with chronic type 2 diabetes mellitus who were receiving care at the Rajiv Gandhi Institute of Medical Sciences and Hospital in Adilabad. This study's findings will aid in the effective treatment of diabetic patients with type 2 diabetes and the prevention of long-term consequences from the disease.

Material and Methods

The study was carried out at the Rajiv Gandhi Institute of Medical Sciences [RIMS], Adilabad, in the Department of General Medicine and Biochemistry. Institutional ethical committee approval was obtained for the study. All research participants were asked for written agreement once the study was explained to them in their vernacular language. Only patients who volunteered to take part in the trial were enrolled. The research had 100 patients in all. They were split into two groups, I and II, each with 50 members. Group, I included both male and female participants with type 2 chronic diabetes mellitus. Those with type 2 diabetes who had been prescribed medication for at least five years were considered chronic diabetics. To rule out the presence of any micro- or macrovascular problems such as retinopathy, peripheral vascular disease, and coronary heart disease, these patients had a clinical examination. Likewise, Group II (n=50) comprised age- and sex-matched controls from the general community as controls. A 10 ml Vacutainer will be used to collect fasting blood samples, and the Beckman Coulter Au 400 fully automatic chemistry analyzer will be used to estimate serum fasting blood sugar, serum electrolytes, and lipid profile. HbA1C was measured using the ion exchange resin technique. By coding the sample, the patient's confidentiality was preserved.

Statistical analysis:

Statistical Package for the Social Sciences (SPSS version 19.0) was used to record and evaluate the results. The continuous variables were represented as mean and standard

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deviations. The categorical variables were recorded as percentages and the differences between the two groups were calculated using the chi-square test and a p-value of < 0.05 was regarded as significant.

Results

In all, 100 patients were included in the trial, and they were split into two groups: group I (diabetics) and group II (controls). Males (n=35) and females (n=15) made up Group I. Their ages ranged from 40 to 69 years old, with a mean of 51.5 ± 5.5 years. The age ranges for the males (n=30) and females (n=20) in group II were 38 to 55 years, with a mean age of 42.5 ± 5.5 years. When the serum fasting blood glucose levels were examined, group I had mean values of 184.5 ± 28.5 mg/dl, and group II had mean values of 98.5 ± 15.5 mg/dl; both groups had significant p values. The mean HbA1c% was statistically different in both groups given in table 1.

Table 1: Showing the levels of glucose and lipid profile in diabetic and control subjects.

Parameter	*Group I [Diabetes Mellitus] Mean ± SD*	*Group II [Controls] Mean ± SD*	*P values*
Age (yrs)	51.5 ± 8.5	42.5 ± 5.5	0.16
Fasting blood glucose (mg/dl)	184.5 ± 28.5	98.5 ± 15.5	0.05*
HbA1c %	8.74 ± 2.51	5.9 ± 1.25	0.04*
The mean duration of diabetes	6.5 ± 3.5	0.00 ± 0.0	-----

* Significant

Estimates of blood triglycerides, cholesterol, HDL, and LDL were used to determine the patients' lipid profiles. The triglyceride levels in group I patients significantly increased when compared to controls; the mean values in group I were 210.25 ± 38.5 mg/dl and group II were 180.5 ± 27.8 mg/dl, with significant p values. Although group I had greater cholesterol levels than group II, the differences were not significant. The HDL-C values were also higher in group II (42.5 4.5 mg/dl) than in group I (35.5 ± 3.5 mg/dl), but the difference was significant. Compared to group II, the LDL-C levels in group I were 125.5 ± 25.5 compared to group II values of 95.5 ± 20.5 mg/dl details depicted in table 2.

Table 2: Lipid profile recorded in two groups of cases in the study.

Parameter	*Group I [Diabetes Mellitus] Mean ± SD*	*Group II [Controls] Mean ± SD*	*P values*
Triglycerides (mg/dl)	210.25 ± 38.5	180.5 ± 27.8	0.032*
Cholesterol (mg/dl)	199.5 ± 45.5	181.65 ± 35.5	0.453
HDL-C (mg/dl)	35.5 ± 3.9	42.5 ± 4.5	0.05*
LDL-C (mg/dl)	125.5 ± 25.5	95.5 ± 20.5	0.041*

* Significant

The most significant macro electrolytes known to fluctuate in individuals with diabetes mellitus are sodium, potassium, chloride, and bicarbonate, hence the serum electrolyte levels of the patients were measured. Although the serum sodium levels in group II were marginally

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higher than in group I, the p-values did not seem to be statistically significant. As opposed to group II, group I (diabetes) had higher potassium levels, and the p values were shown to be significant. The levels of chloride were discovered to be essentially the same in both groups and not noteworthy. In group I, the bicarbonate levels were very slightly higher, but the data in table 3 did not indicate any significance.

Table 3: Comparison of Serum electrolytes in 2 study groups

Electrolyte	*Group I [Diabetes Mellitus] Mean ± SD*	*Group II [Controls] Mean ± SD*	*P values*
Sodium (mmol/L)	138.10 ± 5.2	140.5 ± 3.9	0.122
Potassium (mmol/L)	4.5 ± 0.8	3.4 ± 0.70	0.030*
Chloride (mmol/L)	103.1± 4.0	108.2 ± 5.0	0.354
Bicarbonate (mmol/L)	25.2 ± 3.0	26.5 ± 1.8	0.954

* Significant

Discussion

A myriad of interlinked plasma lipid and electrolyte abnormalities are linked to diabetes mellitus. Every organ in the body is harmed by long-term diabetes mellitus, but the kidneys suffer the most [8–10]. Acid-base imbalances and electrolyte abnormalities affect these individuals. It is brought on by prolonged glucose increase, renal conditions, and pharmaceutical usage [11]. In the current investigation, we discovered that group I patients with chronic diabetes had a higher mean glucose level. Because certain irregularities and electrolyte problems may not show up in new instances and take time to develop, we included patients in our research who had had diabetes for more than five years. In the entire current study, the mean number of years with diabetes was 6.5 ± 3.5 years. The mean HbA1c levels were 8.74 ± 2.51% in the group I diabetics and 5.9 ± 1.25% in the control group II normal. These findings were not determined to be statistically significant (table 1). According to past investigations, HbA1c and blood glucose levels are associated [12]. Additionally, it has been demonstrated that a high HbA1c level increases the likelihood of developing microangiopathy [13, 14]. In related research, N Kumar J et al., [15] found that the diabetes group's mean HbA1c values were 8.5 2.1%. Lipid abnormalities and diabetes mellitus have frequently been linked. Numerous variables, including the type of diabetes, endogenous insulin reserve, degree and distribution of obesity, and presence of nephropathy, affect the kind of abnormality. The most notable anomaly in the current investigation, according to our findings, was an increase in blood lipids in diabetes individuals. Serum triglyceride levels are 1.5–3.0 times higher in type 2 diabetes patients compared to age- and sex-matched non-diabetic controls. Although there was a modest rise in our investigation, it was determined to be meaningful. In the current study, we also noted that diabetes individuals have lower HDL cholesterol and higher LDL cholesterol. Patients with diabetes are supposed to experience a 10–20% fall in HDL cholesterol, although LDL levels are predicted to be within the normal range. The current study did find a modest rise; however, it was not significant. Increased rates of LDL cholesterol production have been associated with higher levels of total and LDL cholesterol in type 2 diabetes [17, 18]. Zargar A et al. [19] in a similar study on 50 obese types 2 diabetes patients indicated that triglycerides and cholesterol were both considerably raised, along with LDL cholesterol, which is consistent with the findings of our investigation. Due to insulin insufficiency, hyperglycemia, and hyperketonemia, it is known that patients with diabetes mellitus experience changes in their electrolyte and water balances [20]. In the current investigation, we discovered that group II had somewhat higher serum sodium levels

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than group I did, but the p values did not prove to be statistically significant. Drugs or hyperglycemia are not necessary for the association between DM and hyponatremia to exist [21]. In one investigation, blood glucose levels were too low to adequately explain the degree of hyponatremia in 5179 community individuals with diabetes who were >55 years old (OR = 1.98; 95%CI: 1.47-2.68). The interplay between insulin and vasopressin, both of which operate on renal collecting ducts, as well as the explanation of the resorption of more hypotonic fluid due to delayed stomach emptying, are some of the postulated explanations [23–25]. According to the results of the current investigation, diabetics have considerably higher potassium levels than healthy patients. Reports on potassium levels in people with diabetes mellitus are inconsistent. While Mcdonnell et al., [26] showed little variations in potassium levels in people with diabetes mellitus. Ugwuja et al., [27] observed that diabetics had lower serum K+ levels than controls. Only 0.6% of diabetic patients had hypokalemia, while 1.2% of diabetes patients had hyperkalemia, according to Wang et al., [28]. A transfer of potassium from the extracellular compartment (shift hyperkalemia) without an increase in the body's potassium levels is one of the reasons for potassium level disturbances. Acidosis, which occurs in diabetes mellitus, produces a drop in pH; for every 0.1 drop in pH, potassium levels rise by 0.4 mmol/L. Reduced tubular K+ secretion caused by the condition of hyporeninemic hypoaldosteronism is a significant factor in persistent hyperkalemia in diabetics [29]. In the current investigation, the levels of the other ions, chloride, and bicarbonates, were not substantially related to diabetes mellitus.

Conclusion

From the present study, it is clear that people with type 2 diabetes have an aberrant lipid and electrolyte balance. Enzymatic activity, hormone production, and antioxidant levels can all be affected by altered mineral metabolism. As a result, monitoring these individuals every three months will aid in reducing the development of long-term diabetes-related problems and complications.

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