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Asymptomatic Hypokalemia in Uncontrolled Type II Diabetes Mellitus

Gunanithi.K[1], Sakthi Dasan.S [2]
[1]*Assistant Professor, Department of Biochemistry, Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research, Tamil Nadu, India.*
[2] *Associate Professor, Department of Biochemistry, Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research, Tamil Nadu, India.*

Abstract: *Electrolyte abnormalities are common among patients with type II diabetes mellitus. Disorders of potassium homeostasis including both hyperkalemia and hypokalemia in type II diabetes mellitus have been documented in literatures of research studies and in clinical practice. Diabetes mellitus type II, a disorder of glucose homeostasis is common in India. Potassium, both serum levels and to a lesser extent dietary intake levels, has been associated with incident diabetes. Lower levels of potassium have been found to be associated with a higher risk of diabetes in some studies. Most patients with low potassium levels will usually have muscular, neurological or cardio vascular symptoms. This study was aimed to find whether patients with type II diabetes mellitus have asymptomatic disorders of potassium homeostasis. Our study has shown that asymptomatic hypokalemia is significantly present in patients with type II diabetes mellitus and it correlates with fasting plasma glucose levels. This might pave the way for early screening and possible preventive management before the patient presents with symptoms of hypokalemia.*

Key Words: *Type II Diabetes mellitus, Hypokalemia, Fasting plasma glucose.*

I. Introduction

Diabetes mellitus comprises a group of common metabolic disorders that share the phenotype of hyperglycemia. Several distinct types of diabetes mellitus exist and are caused by a complex interaction of genetics, environmental factors and life style choices. The incidence of Type II diabetes mellitus is increasing in India. The regional burden of type II diabetes mellitus prevalence among south East Asian countries including India has been estimated by the international diabetes federation. The prevalence of type II diabetes mellitus in south east asian countries among adult population aged 20 to 79 years was estimated to be 883 million by year 2013 [1]. Electrolyte disorders are common in clinical practice. They are mainly encountered in hospital populations occurring in a broad spectrum of patients (from asymptomatic to critically ill) and being associated with increased morbidity and mortality [2-4]. Electrolyte abnormalities are common among patients with type 2 diabetes mellitus [5], abnormalities of potassium homeostasis is common among patients with type II diabetes mellitus. Potassium deficiency is a well-established correlate of disturbances in glucose metabolism. However, this association has been best studied in uncommon conditions, such as hyperaldosteronism [6, 7]. The aim of the study is to estimate the levels of potassium in type II diabetes mellitus patients, to compare the same with age and sex matched controls and to find if there is any correlation between serum potassium levels and fasting plasma glucose levels.

II. Materials & Methods

60 individuals aged 40-60 years 30 type II diabetics and 30 controls attending Medicine / Diabetology OPD of a peripheral tertiary referral center Melmaruvathur adhiparasakthi institute of medical sciences and research, Melmaruvathur, Tamilnadu, India were recruited for this study. The protocol of the study was approved by the institutional ethical committee and written informed consent was obtained from all the participants prior to entering the study. All individuals were interviewed at the baseline by the same investigator for a general medical history and complete medical examination.

Inclusion Criteria: Cases included Type II diabetes mellitus patients with fasting hyperglycemia, controls included fasting normoglycemia, non-diabetics.

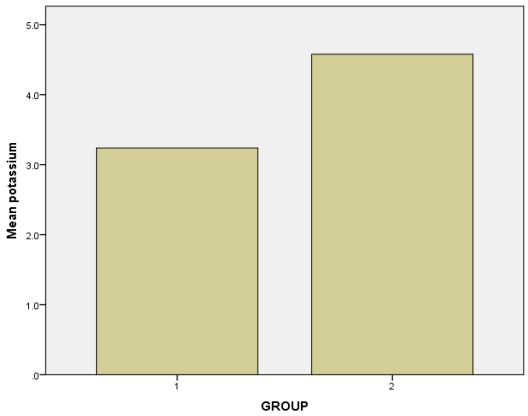
Exclusion Criteria: Those individuals with heart failure, cardiovascular disease, systemic hypertension, liver dysfunction and renal insufficiency, diabetic patients on insulin treatment, on diuretics were excluded from the study.

Investigations, Performed:

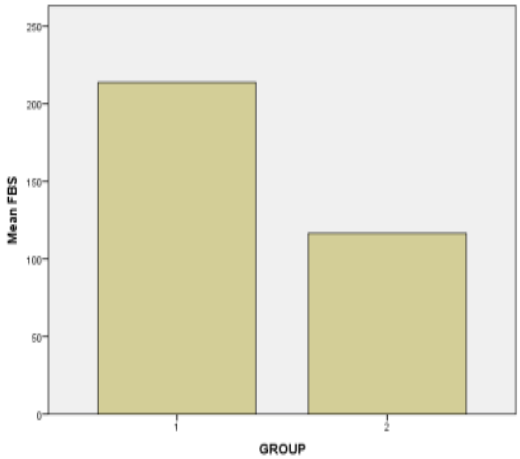
1. Serum potassium by ion selective electrodes method, cobas analyser (standard method)
2. Fasting plasma glucose , by glucose oxidase peroxidase method , fully automated analyser (standard method).

3. Serum Creatinine By Jaffes Kinetic Method, fully automated analyser (standard method).
Statistical analysis for test of significance includes independent sample t test and test of correlation includes pearsons correlation coefficient was performed using SPSS statistical software.

III. Results



Comparison Of Serum Potassium: Mean serum potassium was significantly lower among patients with type II diabetes mellitus (3.23±0.17mEq/L) than with controls (4.57 ±0.40mEq/L). Independent sample t test (t value = 16.43) level of significance (two tailed) at p value 0.000 level.



Comparison Of Fasting Plasma Glucose: Mean serum fasting plasma glucose was significantly higher among patients with type 2 diabetes mellitus (213±77.73 mg/dl) than with controls (116±6.83 mg/dl). Independent sample t test (t value = 6.82) level of significance (two tailed) at p value 0.000 level.

Correlation Between Serum Potassium And Fasting Plasma Glucose: Pearson correlations between fasting blood sugar and serum potassium showed significant negative correlation at 0.01 level (r value = -0.627). Correlation is significant at the 0.01 level (2-tailed).

IV. Discussion

In our study, serum potassium levels were found to be significantly lower in type II diabetic patients than in normal individuals. Reference range for normal serum potassium levels are between 3.5 mEq/L to 5 mEq/L. Hypokalemia is defined as serum potassium falling below 3.5 mEq/L. The causes of hypokalemia in diabetics include: gastrointestinal loss of K+ due to malabsorption syndromes (diabetic-induced motility disorders, bacterial overgrowth, chronic diarrheal states); and renal loss of K+ (due to osmotic diuresis and/or coexistent hypomagnesaemia). There are several studies showing the association between hypokalemia and abnormal glucose metabolism. In a study performed by Rowe *et al.*, hypokalemia was induced with a low-potassium diet and subsequent use of sodium polystyrene sulfate [8]. In this study, the volunteers were determined to have normal glucose tolerance at baseline with a normal oral glucose tolerance test. Potassium depletion was documented with declines in plasma potassium levels ranging from 2.4–3.6 mEq/dl, as well as declines in total body potassium measurements, as measured by a whole body counter. These declines in

potassium levels were associated with declines in insulin release in response to hyperglycemia, which was experimentally maintained with glucose infusions. This study, consistent with other studies, found that the potassium depletion was associated with a decrease in pancreatic β-cell sensitivity to hyperglycemia with a reduction in insulin release. The increased secretion of epinephrine due to insulin-induced hypoglycemia may also play a contributory role [9]. A number of factors contribute to the potassium depletion, including vomiting, increased renal losses due to the osmotic diuresis and ketoacid anion excretion, and the loss of K+ from the cells due to glycogenolysis and proteolysis [10]. Hypokalemia is associated with impaired insulin secretion and decreased peripheral glucose utilization resulting in carbohydrate intolerance and hyperglycemia [11]. These infers that hypokalemia can contribute to hyperglycemia and vice versa.

V. Limitations & Conclusion

Our study has shown that asymptomatic hypokalemia is significantly present in uncontrolled type II diabetes mellitus patients. There are a number of limitations in this study. The sample size is small which did not allow a multivariate approach for incorporating additional , potentially meaningful factors for modifying the levels of serum potassium levels. Nevertheless it seems reasonable that routine screening for serum potassium levels among diabetics provide additional information and then they can have early detection and preventive management of potassium abnormalities and so a better quality of life .

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