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Study of Uric acid and Serum Creatinine in Diabetic and Non-Diabetic patients in a tertiary hospital, Dhaka

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Abstract

Introduction: Diabetes mellitus (DM) type 2 is one of the most common endocrine disorders affecting million people in the world. The current prevalence of 5.5% and the expected rise to 8.2% by 2030 renders diabetes in Bangladesh a major public health problem. All forms of diabetes increase the risk of long-term complications like diabetic retinopathy, diabetic nephropathy, diabetic neuropathy, diabetic foot ulcer, stroke, heart disease, cardiovascular disease, damage blood vessels. Hyperuricemia and high serum creatinine level are risk for diabetic nephropathy.

Methodology: The aim of this study was to evaluate the uric acid and serum creatinine level among diabetic patients. Diabetic subjects were 100 and control subjects 50 were

attending out-patient department during 15 May to 15 September 2022. Patients with known diabetic disease were excluded. Blood samples were analyzed for blood sugar (glucose), uric acid and creatinine on basis of reference laboratory standards in the institute.

Results: Out of 100 diabetic subjects and 50 control subjects, the mean of uric acid level in control group was found to be 5.30 mmol/L whereas in diabetics it was found to be 6.50 mmol/L. The mean creatinine levels in controls was found to be 0.88 mg/dL and in diabetics, it was found to be 2.02 mg/dL.

Conclusion: Uric acid and creatinine are useful, simple biomarkers and prognostic tests of renal failure in diabetic patients.

Keywords: DM, Uric acid, Serum Creatinine, Nephropathy

1. Introduction

Diabetes mellitus is a group of metabolic disease characterized by high blood glucose levels that results from defects in insulin secretion or action or both. It is a leading cause of morbidity and mortality. Prevention of diabetics and its associated burden, primarily cardiovascular morbidity and mortality, has become a health issue worldwide [1]. Currently, about 217 million individuals all over the world live with diabetes mellitus and over 350 million people are likely to live with this condition by the year 2030 [2, 3]. Diabetes mellitus associated with dyslipidemia, hypertension and visceral adiposity, which collectively increase risk of developing chronic kidney disease [4]. To increase prevalence, progression and complications of chronic kidney disease is due to a progressively aging, population, duration of diabetes and presence of hypertension [5]. About one third of type 2 diabetics will eventually have progressive deterioration of renal function⁶. Now this time Diabetic Nephropathy is one the public health concern of diabetic patients.

When blood sugar is increased, it induces stress on kidneys and damage to the blood vessels, leading to kidney disease. The kidneys excrete metabolic waste products and regulate the serum concentration of a variety of substances. At the stage of renal disease, these substances often become abnormal and the extent of the abnormality depends on the severity of the disease. Serum creatinine, serum urea level and uric acid concentrations change inversely with changes in GFR so these are useful to detect the degree of renal dysfunction [7]. Serum Uric acid & creatinine are useful parameters for functioning of the kidney. Creatinine is the breakdown product of creatinine phosphate is releasing from skeletal muscle at a steady rate. Serum creatinine correlates quite well with the percent of the body that is skeletal muscle. It is filtered by the glomerulus, and a small amount is also secreted into the glomerular filtrate by the proximal tubule (hence at low GFR's, the usual reciprocal relationship breaks down and creatinine tends to underestimate how low the GFR has gotten) [8, 9].

Hyperuricemia is a risk factor for type 2 diabetes, but the causal association between them is controversial. A large

epidemiological study of Japanese adult men showed that an elevation of serum uric acid levels increased the risk of type 2 diabetes. Uric acid is the final oxidation product of purine metabolism in humans. There is evidence that hyperuricemia is associated with Uric acid is the final oxidation product of purine metabolism in the metabolic syndrome and incident type 2 diabetes. While some investigations found no association between uric acid levels and the risk of diabetes mellitus, in a recent meta-analysis a positive association was reporting. Although uric acid levels are substantially different between men and women most of the prior studies on this issue were conducted in male populations alone and, if including both men and women, did not conduct gender specific analyses [10].

2. Methodology

100 diabetic subjects as study group and 50 non-diabetic subjects as control group attending the outpatient Department of BIHS General Hospital, Dhaka, Bangladesh, during 15 May to 15 September 2022 were studied. It was a cross sectional analytical study. Diagnosis of diabetes was done based on WHO criteria. A questionnaire was administered in local language containing demographic information. 5 ml of venous blood sample was collected for estimation of blood sugar, uric acid and serum creatinine. Those tests were done automated biochemistry analyzer Dimension RXL Max (Spectrophotometric). The normal ranges for these biomarkers were 3.6-6.1 mmol/L for Serum glucose (F); <11 mmol/L for Serum glucose (1 hr); 0.55-1.3 mg/dL for serum creatinine; 3.4-7 mg/dL (male); 2.4-5.7 mg/dL (Female) for uric acid. Inclusion criteria were, adult diabetic subjects with age ranging from 21-90 years. Exclusion Criteria were patients suffering from any chronic systemic illness like hypertension, any renal diseases like stones, gestational DM, endocrine disorders, alcohol abuse. The aim of our study was to measure uric acid and serum creatinine levels and evaluate their correlation in diabetic and non-diabetic subjects in a tertiary hospital and study the variation in uric acid and creatinine levels in relation to blood sugar levels in type 2 diabetic patients in comparison with the levels in non-diabetic control subjects. Statistical analysis was performed using the SPSS statistical software (version 25; IBM).

3. Results

The total number of subjects were 150 (100 diabetics & 50 controls). Fig 1 shows that out of 100 diabetic subjects 57 (57%) were female and 43 (43%) were male and out of 50 control subjects 24 (48%) were female and 26 (52%) were male subjects.

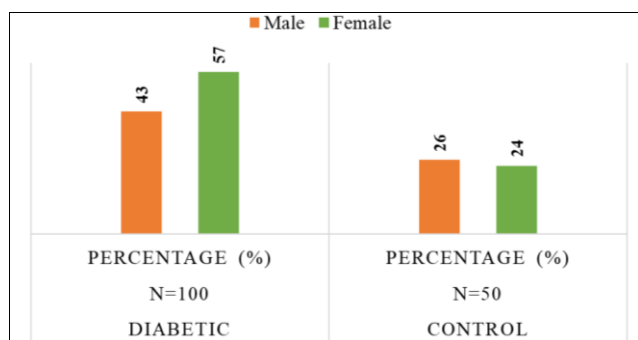


Fig 1: Gender distribution in diabetic patients compared to healthy controls

Fig 2 shows age group distribution in diabetes patients and healthy control group. Maximum diabetic cases were seen in 41-60 age group (48%), followed by 61-80 age group (46%), 20-40 age group (4%), 81-100 age group (2%). The control group age distribution was 41-60 age group (50%), 20-40 age group (32%), 61-80 age group (18%).

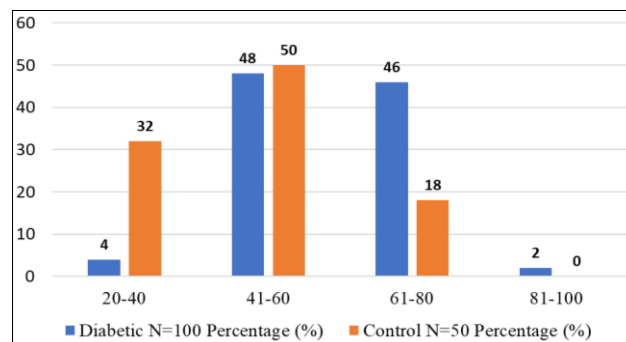


Fig 2: Age group in diabetic patients compared to healthy controls

Fig 3 shows the mean of uric acid level in control group was found to be 5.30 mmol/L whereas in diabetics it was found to be 6.50 mmol/L. The mean creatinine levels in controls were found to be 0.88 mg/dL and in diabetics, it was found to be 2.02 mg/dL. Thus, the mean uric acid and creatinine levels are also visibly higher in the diabetics in comparison to the non-diabetic control group.

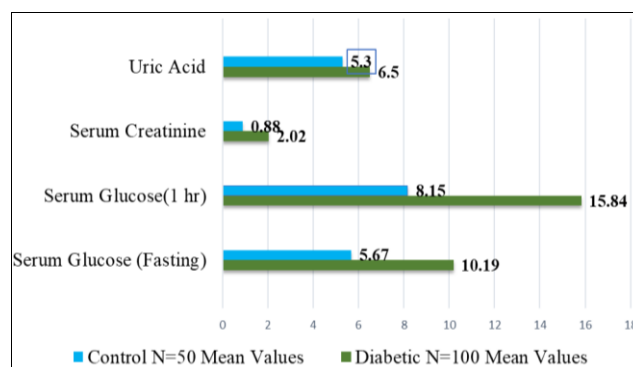


Fig 3: Mean uric acid, creatinine, & blood sugar levels in diabetic patients compared to healthy controls

4. Discussion

A number of mechanisms have been suggested by which uric acid could affect changes in glucose metabolism. Elevated serum uric acid was found to be associated with oxidative stress and systemic inflammation both of which play crucial roles in the development of diabetes mellitus. Some studies reported that there is a positive association between elevated serum uric acid levels and diabetes¹¹, whereas some other study reported no positive association between serum uric acid and diabetes mellitus. Also, some studies reported that serum uric acid is inversely associated with diabetes mellitus [12]. The exact reason for why previous studies found a positive relation between uric acid and diabetes is not clear. Most of these studies were limited by small sample sizes, including either men or women and not both, not having data on confounding factors. In our present study we found serum uric acid is higher in diabetes subjects compared to control group. The elevation of serum uric acid, which is associated with impaired glucose tolerance and newly found type 2 diabetes, seemed to occur

only in the presence of hyperinsulinemia which is apparently a cause as well as a consequence of insulin resistance^[13]. An increase in urea level is seen when there is damage to the kidney or the kidney is not functioning properly. Increment of blood urea level with the increment of blood sugar level clearly indicates that the increase blood sugar level causes damage to the kidney^[14].

High serum creatinine level was seen in males than females, which could be because of storage of creatinine as a waste product in muscle mass and the presence of high muscle mass in males^[15]. In our study creatinine level was higher in diabetes subjects than control group. Male showed slightly higher creatinine level than female but was not significant. Other study showed that high serum creatinine level was seen more in males than females, which could be because of storage of creatinine as a waste product in muscle mass and the presence of high muscle mass in males^[16-17]. Serum creatinine level is one of the markers for renal function examination. Age, gender, protein intake, and muscle mass influence serum creatinine levels. There was no relationship between sex and the blood sugar levels

5. Conclusion

The comparative study of serum sugar and creatinine levels in type-2 diabetic patients showed the blood glucose and serum creatinine concentrations are elevated in type-2 diabetic patients compared with non-diabetic control group^[19]. Good control of blood glucose level helps to prevent progressive renal impairment and diabetic nephropathy is one of major cause of chronic renal failure. Blood urea and creatinine is widely accepted to assess the renal functions. In our study fasting blood glucose level, uric acid and serum creatinine in diabetic patients were significantly higher than non-diabetic control group.

6. Acknowledgement

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Conflicts of Interest: None

Informed consent: Informed consent was obtained from all individuals included in this study.

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