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RENAL FUNCTION TEST ON THE BASIS OF SERUM CREATININE AND UREA IN TYPE-2 DIABETICS AND NONDIABETICS

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Background: Type-2 diabetes mellitus has quickly become a global health problem due to rapidly increasing population growth, aging, urbanization and increasing prevalence of obesity and physical inactivity. Diabetic nephropathy is one of the major causes of chronic renal failure. Both serum urea and creatinine are widely used to assess the function of kidney. This study was conducted to observe the impaired renal function in type 2 diabetics and compare with non-diabetics controls. **Method:** To determine the incidence of renal dysfunction in diabetics in Nepalgunj medical college and Hospital , Nepalgunj , Banke, Nepal , blood samples from 100 diabetic subjects and 100 non-diabetic controls were taken between the period 1st February , 2012 to 31st January , 2013 for investigation of plasma glucose fasting(FPG), blood urea and serum creatinine. These biochemical parameters were determined by using a fully automated clinical chemistry analyzer. **Results**: Our findings showed that the level of blood urea (P<0.0001, 95%Cl) and serum creatinine (P≈0.0004,95%Cl) were significantly higher in type 2 diabetics as compared to non-diabetics in both male and female. There was no significant difference between diabetic male and female. 15 out of 100 diabetes samples have high urea level whereas 7 out of 100 had increased creatinine level. In control only 3 samples had high urea value and 1 had high creatinine level. There was statistical significant increased in urea level with increased in blood sugar level. **Conclusion:** Blood urea and creatinine is widely accepted to assess the renal functions. Good control of blood glucose level is absolute requirement to prevent progressive renal impairment.

Keywords: Type 2 diabetes mellitus, urea, creatinine , renal function

INTRODUCTION

Diabetic mellitus (DM) is a group of metabolic disorder of carbohydrate metabolism in which glucose is under used, producing hyperglycemia. Different statistics have led to diabetes being described as one of the main threat to human health in the 21st century.[1] Type-2 diabetes mellitus has quickly become a global health problem due to rapidly increasing population growth, aging, urbanization and increasing prevalence of obesity and physical inactivity. There is, therefore, an urgent need to prevent diabetes and its complications. Diabetes is the major cause of end stage renal disease (ESRD) both in the U.S. and around the world and has enormous medical, social and economic consequences.[2]

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DM is also the major cause of renal morbidity and mortality.[3] Diabetes is the most common cause of kidney fail-ure, accounting for nearly 44 percent of new cases.[4] Even when diabetes is controlled, the disease can lead to chronic kidney disease (CKD) and kidney failure. Kidney failure is the final stage of chronic kidney disease. Nearly 24 million people in the United States have diabetes and nearly 180,000 people are living with kidney failure as a result of diabetes.[5]

Diabetic nephropathy occurs approximately in one third type-2 diabetic patients[6] and is on rise. In diabetic nephropathy a number of serum markers are known to be deranged with significant morbidity and mortality.[7] Urea and creatinine are the parameters to diagnose functioning of the kidney. Changes in serum creatinine concentration more reliably reflect changes in GFR than do changes in serum urea concentrations. Creatinine is formed spontaneously at a constant rate from creatinine and blood concentrations depend almost solely upon GFR. Urea formation is influenced by a number of factors such as liver function, protein intake and rate of protein catabolism.[8] Measurement of the plasma urea and creatinine is

widely regarded as a test of renal function and serum albumin was an independent risk factor in patients with ESRD.[9] The aim of our study is to measure serum creatinine and urea levels in diabetes and non-diabetic samples and to establish relationship of blood sugar level with urea and creatinine levels.

PATIENTS AND METHOD

The study population consisted of 200 subjects (age and sex matched) divided into two groups: diabetic subjects (n=100) and non-diabetic controls (n=100). This study was carried out in the central laboratory of Biochemistry of the Nepalgunj Medical College and Hospital, Nepalgunj, Banke, Nepal between the period of 1st February, 2012 to 31st January, 2013. Blood samples from subjects and controls were taken for investigation of plasma glucose fasting (FPG), blood urea, and serum creatinine. The diabetic status was defined as per the American Diabetes Association (ADA).[10] Estimation of serum glucose was carried out by glucose oxidase and peroxidase method.[11] Similarly serum urea was estimated by Berthelot's method[12] while creatinine was estimated by alkaline Jaffe's Picrate method.[13] These biochemical parameters were determined by using a fully automated clinical chemistry analyzer. The normal levels of creatinine were considered 0.8 to 1.4 mg/dL. Females usually have a lower creatinine (0.6 to 1.2 mg/dL) than males because they usually have less muscle mass.[14] For urea normal range were considered of 10-45 mg/dL.[17] Ethical approval for the study was taken from the institutional research ethical committee. The results obtained from the above investigation were analyzed and expressed as mean ± SD by using Excel 2007. The comparison was done by student t test by using SPSS version 16.

RESULTS

Table 1 presents the sex and age distribution of non-diabetic and diabetic subjects. Both Type-2 diabetic subjects and non-diabetic controls included 50 male and 50 female with mean age of 48.05 ± 11.72 and 47.76 ± 11.78 respectively.

Table 1
Sex distribution of subjects studied

Group	Male	Female	Mean age (years)
Non-diabetic subjects	50	50	48.13±11.72
Diabetic patients	50	50	47.76±11.78

Impairment renal function due to type 2 diabetes mellitus was assessed by measurement of plasma concentrations of creatinine and urea in both type-2 diabetic subjects and non-diabetic controls. Fasting blood glucose concentration, plasma creatinine and urea concentrations were observed to be significantly higher in type-2 DM subject as compared to non-diabetics controls (Table-2).

Table 2
Blood Glucose, Creatinine and Urea Concentration in Non-diabetic Controls and type-2 Diabetic Subjects.

Parameter	Non-diabetic controls	Diabetic patients subjects	*p* value
Fasting (mg/dL)	90.63±6.17	161.77±20.57	<0.0001
Urea (mg/dL)	27.44±10.10	35.67±20.60	≈0.0004
Creatnine (mg/dL)	0.87±.267	1.14±0.25	<0.0001

Fifteen out of 100 diabetes samples have high urea level whereas 7 out of 100 had increased creatinine level. In control only 3 samples had high urea value and 1 had high creatinine level. There was a significant increased statistically in urea level with increased in blood sugar level.

Table 3
Comparisons of urea and creatinine levels in Non-diabetic controls and diabetic subjects

Parameter	Non-Diabetics	Diabetic	Total
Urea			
High	3 (3%)	15 (15%)	18 (9%)
Normal	97 (97%)	85 (85%)	182 (91%)
Total	100 (100%)	100 (100%)	200 (100%)
Creatinine			
High	1 (99%)	7 (7%)	8 (4%)
Normal	99 (99%)	93 (93%)	192 (96%)
Total	100 (100%)	100 (100%)	200 (100%)

DISCUSSION

Impairment of renal function due to type 2 diabetes mellitus was assessed by measurement of plasma concentrations of creatinine and urea in both tests (diabetic subjects and non-diabetic controls). The plasma creatinine and urea are established markers of GFR, though plasma creatinine is a more sensitive index of kideny function. 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. Research conducted by Anjaneyulu et al 2004 had found that increase urea and serum creatinine in diabetic rats indicates progressive renal damage.[15] Joel Neugartan, et al

studied effect of gender on progression of non-diabetic renal disease in 2000, and according to this study, men with chronic renal disease of various aetiologies show more rapid decline in renal function with time than do women.[16] Our observations we found blood glucose concentration, plasma creatinine and urea concentrations were observed to be significantly higher in type-2 DM subject males and females were in accordance with the study[17,18,19] which showed raised plasma creatinine and urea levels in diabetic patients may indicate a pre-renal problem.This result is supported by various researchers who showed that sex wise variation occurs only in serum creatinine level but not in blood sugar level and urea level. 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.[20] Diabetic nephropathy, especially related to type-2 diabetes, has become the single most important cause of ESRD (end stage renal disease) worldwide. Management of traditional risk factors such as hyper tension, hyperlipidemia, and smoking to improve cardiovascular and renal outcomes continues to be important in patients with chronic kidney disease.

CONCLUSION

Strong relationship of blood urea level was found with blood sugar level. To monitor the diabetes patients, estimation of blood urea level along with blood sugar level could be important. Good control of blood glucose level is absolute requirement to prevent progressive renal impairment.

CONFLICT OF INTEREST STATEMENT

We declare that we have no conflict of interest.

ETHICAL APPROVAL & FUNDING

Ethical approval for the study was taken from institutional research ethical committee. No funding to declare.

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