

Brief Research Communication

A Study on Renal Function Tests and its Correlation with Blood Glucose and eGFR in Newly Diagnosed Type 2 Diabetes Mellitus

Rohitash Kumar¹, Rakesh Kumar², Ranjana Mathur¹, Jairam R¹.

1. Dept of Biochemistry, Dr.S.N. Medical College, Jodhpur, Rajasthan.

2. Dept of Physiology, Dr.S.N. Medical College, Jodhpur, Rajasthan.

Abstract

Background: Elevated values of renal function tests are associated with type 2 diabetes mellitus. But there are studies that found that the levels of creatinine and uric acid are low in cases of diabetes mellitus. Comparative studies related to serum renal function tests with eGFR and blood glucose in type 2 DM is less. Hence the study was undertaken to study the RFT and its correlation with blood glucose and eGFR in type 2 DM. **Materials and Methods:** 25 newly diagnosed cases of type 2 diabetes mellitus and 25 healthy controls were studied. **Results:** Mean serum urea levels were 25.80 ± 6.75 mg/dL in controls and 34.08 ± 9.62 in cases, which was statistically significant. Mean serum creatinine and uric acid values were also statistically significant ($p=0.0002$). Significant positive correlation was found between FBS ($p<0.001$) and PPBS ($p<0.0001$) with the eGFR and renal function tests in both cases and controls. **Conclusion:** our study shows urea, creatinine and uric acid levels are towards higher reference limits in cases compared to controls.

Key-words: eGFR, FBS, PPBS, RFT, uric acid

Introduction

Assessment of renal function tests may be used for two different purposes. One is to diagnose impaired renal function, and the other is to detect the presence of a progressive loss of renal function over time.^[1] Urea and Creatinine are the parameters to diagnose functioning of the kidneys. Changes in serum Creatinine concentration more reliably reflect changes in GFR than do changes in serum Urea concentration.^[2] Hyperuricemia is an independent risk factor for kidney dysfunction in diabetes mellitus.^[3] A positive association between the serum uric acid level and the development of type 2 diabetes mellitus has been reported.^[4] Diabetic nephropathy is a devastating late complication of diabetes in patients with both type 1 and type 2 diabetes.^[5] This study was undertaken to find the levels of renal function tests in type 2 DM and compare it with eGFR and blood glucoses.

Objectives

The objectives of the study were

1. To know the values of RFT in type 2 DM in our study population.
2. To correlate the levels of RFT values with blood glucose and eGFR in type 2 diabetic patients.

Material and methods

This was a Case Control study conducted at outpatient clinics of Department of Medicine, Dr.S.N. Medical College and Associated group of hospitals, Jodhpur during the period from April to August 2013. 25 normal healthy subjects and 25 clinically established patients of either sex and of varying age groups suffering from type 2 DM were included in study. All the study population were asked to come for sample collection after overnight fasting and the blood was collected in fluoride and plain tubes for blood glucose and other parameters respectively. Serum was separated after centrifugation and analysed. Parameters estimated were FBS, PPBS by GOD-POD method, Serum urea by Enzymatic Urease Method, Serum creatinine by Jaffe's method and serum uric acid by enzymatic method. All parameters were analyzed by commercially available reagents and kits on semiautoanalyzers and autoanalyzer in Clinical Biochemistry laboratory, M.D.M Hospital and Research laboratory Dr. S.N. Medical College, Jodhpur. eGFR was Calculated by using Cockcroft-Gault equation.^[6] The results were obtained and values were tabulated.

*Corresponding Author

Dr. Rakesh Kumar.
Dept. of Physiology, Dr.S.N. Medical College,
Jodhpur, Rajasthan E-mail: sagu.rakesh@gmail.com
Received 10th May 2015, Accepted 1st June 2015

An independent t test was done to compare between the cases and controls.

$$eGFR = \frac{(140 - \text{age}) \times \text{body weight}}{72 \times \text{serum creatinine}} \times 0.85 (\text{if female})$$

Results

The Mean serum urea level was 25.80±6.75 mg/dL in controls and 34.08±9.62 in cases. **(Table 1)**. This difference was statistically significant. (p<0.0010). Mean serum creatinine values were highly significant (t= 4.02, p=0.0002) in cases, as compared to controls. **(Table 1)**.

The Mean serum uric acid levels were 4.07±0.68 mg/dL in controls and 5.01±0.78 in cases. **(Table 1)**. This difference was statistically significant (t= 4.52, p<0.0001). **(Fig 1)**

The Mean eGFR levels were 80.08±19.94 ml/min/1.73m² in controls and 60.62±16.08 in cases. This difference was statistically significant. **(Table 1) (Fig 2)**

Significant positive correlation was found between FBS (p=0.006) and PPBS (p=0.04) with the eGFR in cases and controls. **(Table 1)**.

Table 1. Mean values of parameters of cases and controls

Parameters	Cases	Controls	p-value
FBS (mg/dl)	189.40± 36.90	95.44 ± 13.38	<0.001*
PPBS (mg/dl)	232.24± 41.17	132.56 ± 9.56	<0.0001*
Urea (mg/dl)	34.08± 9.62	25.80 ± 6.75	0.0010*
Creatinine (mg/dl)	1.43 ± 0.40	1.05 ± 0.24	0.0002*
URIC ACID (mg/dl)	5.01 ± 0.78	4.07 ± 0.68	<0.0001*
eGFR (ml/min./1.73m ²)	60.62 ± 16.05	80.08 ± 19.94	0.0004*

*Significant

Discussion

Diabetes mellitus is associated with devastating consequences when vascular complications are present. Vascular diseases are the cornerstone of long term complications in diabetes.^[7] In diabetic nephropathy, a number of serum markers are known to be deranged with significant morbidity

and mortality.^[8,9] Diabetes is the most common cause of kidney failure, accounting for nearly 44 percent of new cases.^[10] Serum Creatinine and Urea concentration change inversely with changes in GFR and therefore useful in gauging the degree of renal dysfunction.^[11,12] Hyperuricemia has been found to be associated with obesity and insulin resistance and consequently with type 2 diabetes mellitus.^[13] Hyperuricemia induces endothelial dysfunction which results in nephropathy in type 2 DM patients.^[14] study done by Tseng also says even mild hyperuricemia will results in kidney injury. ^[15] In this study, we observed renal function tests values towards higher reference limits in type 2 DM patients. Urea, creatinine and uric acid levels were higher in cases compared to controls, which was statistically significant (table 1). Blessing O *et al*, Meera KS *et al*.^[16] found the same results in a population based study. Our study shows positive correlation of uric acid levels with FBS and PPBS in cases and it was statistically significant. Studies have shown that diabetic patients have higher uric acid clearance and serum uric acid level was lower than in controls. Their analysis showed that diabetic patients had increased fractional excretion of uric acid.^[17,18] Another finding in our study is that uric acid and eGFR are positively correlated in both cases and controls which is statistically significant. So when the levels of uric acid increases in the diabetic patients, the eGFR decreases and this relation is statistically significant. This shows that higher values of RFT induced endothelial dysfunction in kidney may lead to diabetic nephropathy. Another observation noted in our study was a positive correlation existing between blood glucose levels (FBS&PPBS) with eGFR as shown in figure. It may be due to the hyperfiltration of glomerulus during the early diabetes, which at later stage is known to decrease eGFR whith development of nephropathic changes. Hence along with eGFR and other routine markers, Renal Function Tests could aid in the management and long term treatment of Type 2 diabetes mellitus. They should be recommended to be included in the panel of routine investigations for proper management of type 2 DM to prevent diabetic nephropathy.

Conclusion

The tendency of occurrence of renal function tests value at the higher reference limits in cases of type 2 diabetes mellitus reflects the initiation of nephropathy changes. So along with eGFR, estimation of Renal function tests is simple, sensitive, reliable and economic that can now be considered as an adjunct in the management and long term treatment of Type 2 diabetes mellitus.

References

1. Hsu CY, Chertow MG and Curhan GC, Methodological issues in studying the mild to moderate chronic Renal Insufficiency. *Kidney Int* 2002; 61: 1567-76.
2. Bonakdaran S, Hami M and Shakeri MT. Hyperuricemia and albuminuria in patients with type 2 diabetes mellitus. *Iran J Kidney Dis*. 2011; 5(1):21-4.
3. Spijkerman AM, Dekker JM, Nijpels G. Microvascular Complications at time of diagnosis of type 2 diabetes are similar among diabetic patients detected by targeted screening and patients newly diagnosed in general practice: the Hoorn screening study. *Diabetes Care*. 2003; 26: 2604-08.
4. Konard Walczak, Malgorzata Sodolska. Impaired Renal Function in type 2 Diabetes Patients in the absence of increased urinary albumin excretion rate; *Diabet Dosw I Klin* 2008; 8 (4): 165-68.
5. Liny Y, Xuy, Chen G, Huang B and Yaol; Glycosylated hemoglobin, Diabetes Mellitus and CVD in a study in Chinese population, *N Engl J Med*; 2010; 295k: 417-20.
6. Cockcroft DW and Gault MH; Prediction of creatinine clearance from serum creatinine. *Nephron* 1976; 16:31-41.
7. Berry C., Tardif J.C. and Bourassa M.G. Coronary heart disease in patients with diabetes: part I: recent advances in prevention and non-invasive management. *J Am Coll Cardiol* 2007; 49:631-42.
8. Taniguchi A, Fukushima M *et al*, Studies on diabetic nephropathy and secondary disease in type II diabetes mellitus. *Int J Diab*. 2003; 25:25-29.
9. Thelle and T. P. White head. Serum uric acid, serum glucose and diabetes: relationships in a population study. *Postgrad Med J*. 1986; 62 (733): 1001-06.
10. National kidney foundation: 'Clinical practice guidelines for chronic kidney disease: evaluation, classification and stratification' *American journal of kidney diseases* 2002; 39: S1 266 PMID 11904577.
11. Mitch WE and M Walser (1986); Measuring the Rate of Renal Insufficiency. In Contemporary Issues of Nephrology: Progressive Nature of Renal Disease, Mitch W.E., Brenner and J.H. Stein (Eds.).Vol. 14, Churchill Livingstone, New York, pp:167-187.
12. Schutte JE *et al*(1981); Total Plasma Creatinine: an accurate measure of total striated muscle mass. *Journal of Applied Physiology*; 1981; 51:762-66.
13. Blessing O *et al*. Plasma Glucose, Creatinine and Urea levels in type 2 Diabetic patients attending a Nigerian teaching hospital. *Research Journal of Med. Science* 2011; 5 (1): 1-3.
14. Ganesh G, Krishnamurthy N and Ashakiran S ; A study of Serum Uric acid levels and its correlation with blood Glucose and eGFR in type 2 Diabetes Mellitus patients at a rural tertiary care center in kolar. *J Clin Biomed Sci*; 2012; 2 (2) 79-86.
15. Tseng CH. Correlation of uric acid and urinary albumin excretion rate in patients with type 2DM in Taiwan. *Kidney Int*.2005; 68: 796-801.
16. Meera KS, and Vasudha KC. The study of serum Uric acid in non insulin dependent Diabetes Mellitus. *Asian J Bio Res*. 2011; 1(3):260-66.
17. Ishihara M, Shinoda T, Yamada T. Co-occurrence of hypercalciuria and hyperuricemia in type 2 diabetes mellitus. *Diabet Med*. 1989; 5(5): 406-11.
18. Gonzalez SL *et al*. Renal metabolism of uric acid in type I insulin non-dependent diabetes patients: Relation to metabolic compensation. 1997; 29(10): 250-53.