Correlation of Renal Profile with HbA1c in Chronic Diabetes Patients.

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ABSTRACT

Background: The chronic hyperglycemia of diabetes is associated with damage and failure of various organs, specially the eyes, kidneys, nerves, heart, and vascular system. Diabetes is the major cause of end-stage renal disease and diabetic nephropathy which are also called as diabetic kidney disease. **Methods:** We conducted a cross sectional study on 45 diabetic subjects as study group and 45 non-diabetic subjects as control group attending out-patient department at the AIIMS, Bhubaneswar. Diagnosis of diabetes was done on the basis of WHO criteria. All the subjects between 27-75 years were included in this study. **Results:** Correlation of serum urea, creatinine and uric acid with HbA1c diabetics group by Pearson's coefficient correlation. Significant positive correlation was found between renal profiles with HbA1c. **Conclusion:** The linear relationship of renal profiles was found with increased levels of HbA1c in diabetic patients. To monitor the diabetes patients, estimation of renal profiles along with HbA1c level is highly recommended. Serum urea and creatinine are simple and useful biomarkers which can serve as predictor tests for assessing kidney functions (nephropathy) in diabetic patients.

Keywords: Diabetes Mellitus, Glycated Hemoglobin and Renal Profile.

INTRODUCTION

In the ancient Sanskrit literature, diabetes mellitus was described as "honey-urine disease," associated with gross emaciation and wasting. Diabetes Mellitus (DM) comprises a group of common metabolic disorders that share the phenotype of hyperglycemia. It is a global endemic with rapidly increasing prevalence in both developing and developed countries.[1] WHO has declared India as "Diabetic Capital of the world".[2] Although the prevalence of both type 1 and type 2 DM is going to increase, type 2 DM is expected to rise more rapidly in future because of increased obesity and reduced activity levels. The chronic complications of DM affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease. Glycated hemoglobin (HbA1c) is routinely used as a diagnostic tool for measuring long term glycemic control. In accordance with its function as an indicator for the mean blood glucose level, HbA1c predicts the risk for the development of diabetic complication in diabetes patients.

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The chronic hyperglycemia of diabetes is associated with damage and failure of various organs, especially the eyes, kidneys, nerves, heart, and vascular system.

Diabetes is the major cause of end-stage renal disease and diabetic nephropathy which are also called as diabetic kidney disease. 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.[3] Hyperuricemia is an independent risk factor for kidney dysfunction in type 2 diabetes mellitus.[4] A positive association between the serum uric acid level and the development of diabetes mellitus has been reported.[5] Diabetic nephropathy is a devastating late complication of diabetes in patients with both type 1 and type 2 diabetes.[6] This clinical study demonstrated that improvements in glycemic control, particularly early in treatment, are associated with reductions in the incidence of microvascular complications, including chronic kidney disease.[7–15] Notably, the Diabetes Control and Complications Trial showed a significant relationship between reduction in glycosylated hemoglobin (HbA1c) levels and the risk of microvascular complications including chronic kidney disease.[7,8,15] Aim of the study was to be the correlation of renal profile with HbA1c in chronic diabetes patients.

MATERIALS AND METHODS

This present study was conducted in Department of Biochemistry, AIIMS, Bhubaneswar, India during the period from August 2014 to January 2015. 45 diabetic subjects as study group and 45 non-diabetic subjects as control group attending out-patient department at the AIIMS, Bhubaneswar. Diagnosis of diabetes was done on the basis of WHO criteria. All the subjects between 27-75 years were included in this study. Patients with urinary tract obstruction, congestive cardiac failure, other chronic kidney disease, myopathy or muscular dystrophy were excluded from the study.

All the study population were asked to come or 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, Glycated Haemoglobin (GHb) by cation exchange resin methods.[16] 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, AIIMS, Bhubaneswar. eGFR was Calculated by using Cockroft-Gault equation.[17]

RESULTS & DISCUSSION

This present study was conducted in Department of Biochemistry, AIIMS, Bhubaneswar. [Table 1] indicates mean±SD of fasting and post-meal blood sugar levels and HbA1c levels in between cases and controls group. There was a significant increase in cases as compared to control group. HbA1c levels were significantly higher in cases as compared to control group. Table 1 also the mean serum urea level was 36.8 ± 6.2 mg/dL in cases and 24.40 ± 6.5 in controls. This difference was highly significant ($p<0.001$). The mean serum creatinine level was 1.45 ± 0.20 mg/dL in controls and 1.03 ± 0.41 in cases. This difference was highly significant ($p<0.003$). The mean serum uric acid levels were 6.21 ± 0.5 mg/dL in cases and 4.24 ± 0.86 in controls. This difference was highly significant ($p<0.001$). The mean eGFR levels were 62.02 ± 14.2 ml/min/1.73m2 in cases and 82.02 ± 16.4 in controls. This difference was highly significant ($p<0.002$).

Table 1: Comparison of parameters between cases and controls.

Parameters	Cases(Mean ± SD)	Controls(Mean ± SD)	p-value
FBS (mg/dl)	187.61± 37.54	85.68±7.52	<0.001
PPBS (mg/dl)	234.26± 42.7	130.6 ± 8.34	<0.001
HbA1c (%)	7.54±0.05	5.32±0.40	<0.001
Urea (mg/dl)	36.8± 6.2	24.40 ± 6.5	<0.001
Creatinine (mg/dl)	1.45 ± 0.20	1.03 ± 0.41	<0.003
Uric Acid (mg/dl)	6.21 ± 0.5	4.24 ± 0.86	<0.001
eGFR (ml/min./1.73m2)	62.02 ± 14.2	82.02 ± 16.4	<0.002

(Statistically significant p<0.05)

Table 2: Correlation of study parameters with HbA1c.

Renal Profile	HbA1c
Urea	0.017
Creatinine	0.010
Uric Acid	0.014

[Table 2] shows the correlation of serum urea, creatinine and uric acid with HbA1c diabetics group by Pearson's coefficient correlation. Significant positive correlation was found between renal profiles with HbA1c.

Diabetes mellitus is a major cause of morbidity and mortality. Diabetic nephropathy is the kidney disease that occurs as a result of diabetes. An international study has reported that diabetes control worsened with longer duration of the disease, with neuropathy as the most common complication followed by cardiovascular complications, renal complications, retinopathy, and foot ulcers. In diabetic nephropathy, a number of serum markers are known to be deranged with significant morbidity and mortality.[18,19] Diabetes is the most common cause of kidney failure, accounting for nearly 44 percent of new cases.[20] Serum Creatinine and Urea concentration change inversely with changes in GFR and therefore useful in gauging the degree of renal dysfunction.[21,22] In this study, we observed renal function tests values towards higher reference limits in Diabetic 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 and Rohitash K et al.,[23,24] found the same results in a population based study. Our study shows positive correlation of renal profiles with HbA1c in cases and it was statistically significant. The reduced filtering capacity of the kidney in diabetic patients would lead to accumulation of waste products and thereby increase in serum urea, creatinine and uric levels.[25] Impaired function of the nephron in diabetic patients causes high serum creatinine level.[26] The elevated levels of serum urea and creatinine are the measures of glomerular damage which can, in no way be reversed by intensive treatment plan. The only way to control this progressive glomerular damage and

thereby elevated levels of serum and creatinine web would be early detection and intervention.

CONCLUSION

These findings suggest that, the linear relationship of renal profiles was found with increased levels of HbA1c in diabetic patients. To monitor the diabetes patients, estimation of renal profiles along with HbA1c level is highly recommended. Serum urea and creatinine are simple and useful biomarkers which can serve as predictor tests for assessing kidney functions (nephropathy) in diabetic patients. The tendency of occurrence of renal function tests value at the higher reference limits in cases of diabetes mellitus reflects the initiation of nephropathy changes.

REFERENCES

1. MK Yadav, TK Mohapatra, RK Mohapatra, et al. Study on Glycated Hemoglobin & lipid profile in Type-2 Diabetes Mellitus. International Journal of Science & Research (IJSR) , June 2015; 4(6):1917-19.
2. Gupta V, Diabetes in Elderly patients. JK practitioner, 2002; 91(4): 258-259.
3. 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.
4. Spijkerman AM, Dekker JM, Nijpels G, Adriaanse MC, Kostense PJ, Ruwaard D et al; 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(9): 2604–2608.
5. Walczak K, Sodolska M, Materek I, Krysicka A, Moczulski D; Impaired Renal Function in type 2 Diabetes Patients in the absence of increased urinary albumin excretion rate. Diabet Dosw I Klin, 2008; 8(4) 165-168.
6. Lin Y, Xu Y, Chen G, Huang B, Chen Z, Yao L, Chen Z; Glycated hemoglobin, diabetes mellitus, and cardiovascular risk in a cross-sectional study among She Chinese population. J Endocrinol Invest, 2012;35(1):35-41.
7. Effect of intensive therapy on the development and progression of diabetic nephropathy in the Diabetes Control and Complications Trial. The Diabetes Control and Complications (DCCT) Research Group. Kidney Int 1995;47:1703–20.
8. Retinopathy and nephropathy in patients with type 1 diabetes four years after a trial of intensive therapy. The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Research Group. N Engl J Med 2000;342: 381–9.
9. Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. Lancet 1998;352:837–53.
10. Holman RR, Paul SK, Bethel MA, Matthews DR, Neil HA. 10-year follow-up of intensive glucose control in type 2 diabetes. N Engl J Med 2008;359: 1577–89.
11. Skyler JS. Diabetic complications: the importance of glucose control. Endocrin Metab Clin North Am 1996;25:243–54.
12. Stratton IM, Adler AI, Neil HA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. Br Med J 2000;321: 405–412.
13. Bash LD, Selvin E, Steffes M, Coresh J, Astor BC. Poor glycemic control in diabetes and the risk of incident chronic kidney disease even in the absence of albuminuria and retinopathy. Arch Int Med 2008; 168:2440–7.
14. Ismail-Beigi F, Craven T, Banerji MA, et al. Effect of intensive treatment of hyperglycaemia on microvascular outcomes in type 2 diabetes: an analysis of the ACCORD randomized trial. Lancet 2010;376:419 –30.
15. Lachin JM, Genuth S, Nathan DM, Zinman B, Rutledge BN. Effect of glycemic exposure on the risk of microvascular complications in the diabetes control and complications trial–revisited. Diabetes 2008;57: 995–1001.
16. Gabby, K H et al. – J. Clin. End. Met. 44:859,1977.
17. Cockcroft DW, Gault MH; Prediction of creatinine clearance from serum creatinine. Nephron, 1976; 16:31-41.
18. Rehman G, Khan SA, Hamayun M; Studies on diabetic nephropathy and secondary diseases in type 2 diabetes. Int. J. Diabetes Dev. Countries, 2005; 25:1-5.
19. Cook DG, Shaper AG, Thelle DS; Serum uric acid, serum glucose and diabetes: relationships in a population study. Postgrad Med J, 1986; 62(733): 1001–1006.
20. National kidney foundation; Clinical practice guidelines for chronic kidney disease: evaluation, classification and stratification' American journal of kidney diseases , 2002; 39: S1 266.
21. Mitch WE, Walser M; 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, 1986;167-187.
22. Schutte JE, Longhurst JC, Gaffney FA, Bastian BC, Blomqvist CG; Total Plasma Creatinine: an accurate measure of total striated muscle mass. Journal of Applied Physiology; 1981;51(3): 762-766.
23. Meera KS, and Vasudha KC; The study of serum Uric acid in non insulin dependent Diabetes Mellitus. Asian J BIO Res, 2011; 1(3):260-266.
24. Rohitash K et al., A Study On Renal Function Tests and its Correlation With Blood Glucose And EGFR in Freshly Diagnosed Type-2 Diabetes Patients Sch. Acad. J. Biosci., 2014; 2(10):675-677.
25. Singh VP, Bali A, Singh N, Jaggi AS. Advanced glycation end products and diabetic complications. Korean J Physiol Pharmacol. 2014;18(1):1-14.
26. Mishra KP, Mawar A, Kare PK, Verma N. Relationship between fasting blood glucose, serum urea, serum creatinine and duration of diabetes in Type-2 diabetic patients. Flora Fauna. 2015;21(1):127-32.