



## A study of renal function tests in South Indian diabetic patient population

Bhat Ramesh M<sup>1</sup>, Ganaraja B<sup>2\*</sup>

<sup>1</sup>Professor, <sup>2</sup> Associate Professor, Department of Physiology, KMC., Centre for Basic Sciences, (A Unit of Manipal University) Bejai, Mangalore – 575 004, India.

Received on: 20-08-2011; Revised on: 15-09-2011; Accepted on: 10-11-2011

### ABSTRACT

**Objective :** To study the renal function in chronic Diabetes mellitus in relationship to the duration and diabetic control in order to predict renal complications such as nephropathy. **Methods:** The study group consisted of 50 patients aged between 15 to 80 years with history of Uremia and nephropathy due to diabetes mellitus. Patients were divided into two groups on the basis of duration of diabetes I < 25 years & II > 25 and into three groups I < 300 mg/dl, II 301-359 mg/dl & III > 360 mg/dl depending on random blood sugar levels. Their age, sex, duration of diabetes and Blood pressure were recorded. Their serum creatinine, Blood urea nitrogen and random blood sugar were determined using Auto-analyzer method. Urinary protein was measured by chemical analysis. **Results:** Urinary Proteins showed a highly significant (p value < 0.01) increase in > 25yrs group but Serum creatinine and blood urea nitrogen did not show any significant difference between < 25 years & > 25 years duration group. Both systolic & Diastolic blood pressures showed Very highly significant increase (P value < 0.001) in > 25 years group. Serum creatinine, blood urea nitrogen & Urinary Proteins showed a highly significant (p < 0.01) & very highly significant increase (p < 0.001) between the 3 groups increasing linearly with Random blood sugar. **Conclusion:** Early detection of renal complications in diabetes mellitus such as Nephropathy is essential. Renal function tests to detect proteinuria must be performed regularly to prevent the rapid progression of renal pathology in diabetic patients.

**Key words:** Renal function tests, Diabetic Nephropathy, duration of diabetes, random blood sugar.

### INTRODUCTION

Diabetes is a condition affecting millions of people worldwide and in India the diabetic patients are more than 50 million. This endocrine disorder precipitates several other complications. Diabetic nephropathy is one among them. Diabetic nephropathy is a clinical syndrome characterized by persistent albuminuria (>300 mg/d or >200 µg/min), elevated arterial blood pressure & progressive decline in the glomerular filtration rate (GFR) and eventually end stage renal failure. Patients generally have diabetic retinopathy. Recently the close links between nephropathy and cardiovascular disease have led to the inclusion of premature cardiovascular disease, cardiovascular risk increasing in parallel with albuminuria [1]. Diabetic nephropathy is one of the leading causes of chronic renal failure in India. It has been reported that among 4837 patients with chronic renal failure seen over a period of 10 years, the prevalence of diabetic nephropathy was 30.3% followed by chronic interstitial nephritis (23.0%) and chronic glomerulonephritis (17.7%) [2].

Several studies have suggested that 80% of type I diabetic patients with microalbuminuria would progress to proteinuria [3, 4]. However, more recent studies suggest that around one third of microalbuminuria patients will revert to normal albumin excretion and only one third progresses to proteinuria [5, 6].

Several studies have demonstrated that the rates of development of microalbuminuria and proteinuria in type II diabetic patients are approximately comparable to those in type I patients [7, 8]. So it is clear from the above studies that incidence of uncontrolled Diabetes type I & II progressing into Nephropathy are very high. Developing countries such as India with its large burden of diabetes and vulnerability to the chronic complications including diabetic nephropathy obviously must evolve strategies for primary prevention of diabetes and also for prevention of its secondary complications. Early detection, screening and appropriate therapeutic interventions are the first steps towards achieving this goal. [9]. Hogeman. O et al have outlined the importance of renal function in diabetic nephropathy. [10] They concluded that a simple renal function test such as determination of urine albumin is used for the screening of patients with diabetes may predict the early onset of

diabetic nephropathy in these patients. Therefore, renal function tests in diabetics especially those with diabetic nephropathy are not only very important in the early diagnosis but also in the prognosis of the disease. The commonly used parameters to assess renal function are serum creatinine, blood urea, creatinine clearance (and hence GFR), urine microscopy, and tests for proteinuria. The present study has been undertaken to study the efficacy of renal function tests such as serum creatinine, blood urea nitrogen & urinary protein in the early detection of diabetic Nephropathy and to compare them with age, sex, duration of diabetes and random blood sugar.

### MATERIALS AND METHODS:

The study group consisted of 50 patients aged between 15 to 80 years with history of diabetes mellitus who visited the teaching Hospital in South India. Patients with renal pathology due to other causes such as nephritis or nephrotic syndrome were excluded. Their age, sex, duration of diabetes and Blood pressure were recorded. Their serum creatinine (SC mg/dl), Blood urea nitrogen (BUN mg/dl) and random blood sugar were determined using Auto-analyzer method. Urinary protein (UP mg/dl) was measured by chemical analysis. Their Systolic blood pressure (SBP) and Diastolic Blood Pressure (DBP) in mmHg were also estimated.

Written informed consent of all the patients was taken. Ethics committee clearance was taken before starting the study.

Patients were divided into groups as follows:

1. Age below 60 years & above 60 years
2. Males & Females.
3. Duration of diabetes into 2 groups < 25 years & > 25 years and finally
4. Random blood sugar into 3 groups Group I: < 300 mg/dl, Group II: 301-359 mg/dl & Group III: > 360 mg/dl.

Parameters from all these groups were compared among the groups.

**Statistical analysis:** was done using ANOVA, Mean, Standard Deviation, p Value in different groups were analyzed.

### RESULTS:

In the age groups of below 60 and above 60 years, the values of serum creatinine, Blood urea nitrogen, urinary protein and blood pressure (systolic & diastolic) were elevated. But blood pressure (SBP & DBP) and urinary protein of the group above 60 years was significantly higher than that in the group below 60 years (p < 0.001) whereas other parameters did not show any significant difference among the groups.

### \*Corresponding author.

Dr Ganaraja B, PhD.

Associate professor,

Department of Physiology,

KMC., Centre for Basic Sciences,

(A Unit of Manipal University)

Bejai, Mangalore – 575 004, India.

Tel.: +91 9449642150.

E-mail: ganaraj.b@gmail.com

Table 1: showing age wise characteristics of renal function tests parameters.

Name of test	age	number	mean	Std.dev	p.value
SC	<60 yr	29	10.0931	2.70765	p<0.145ns
	>60 yr	21	11.1524	2.16486	
BUN	<60 yr	29	155.1379	41.18402	p<0.272ns
	>60 yr	21	168.9048	46.05421	
UP	<60 yr	29	2.0256	0.2134	p<0.001vhs
	>60 yr	21	2.7832	0.2324	
SBP	<60 yr	29	146.3448	20.64024	p<0.001vhs
	>60 yr	21	178.1905	17.34249	
DBP	<60 yr	29	88.1379	6.323	p<0.001vhs
	>60 yr	21	100.7619	10.6485	

ns-not significant, hs- highly significant, vhs- very highly significant. These parameters did not show any significant difference between males & females.

Table 2: Renal function test parameters among males and females. (ns=not significant)

Name of test	gender	number	mean	Std.dev	p.value
SC	M	35	10.5543	2.53729	0.957ns
	F	15	10.5000	2.58788	0.945ns
BUN	M	35	160.1714	42.98597	0.812ns
	F	15	162.6667	45.77065	0.845ns
UP	M	35	2.7628	0.2346	0.624ns
	F	15	2.7812	0.2148	0.612ns
SBP	M	35	163.0286	23.99692	0.182ns
	F	15	152.0000	25.96701	0.153ns
DBP	M	35	94.6857	10.22043	0.244ns
	F	15	90.5333	10.67619	0.200ns

When these parameters were compared between 2 groups < 25 years & > 25 years in relation to the duration of diabetes showed the following results:

Serum creatinine & Blood urea nitrogen did not show any significant difference between the 2 groups (Table: 3) whereas Urinary protein showed a highly significant increase (p<0.01) in > 25yrs duration group. Both systolic & diastolic blood pressures showed a very highly significant (p<0.001) increase in > 25yrs duration group.

Table 3: RFT Parameters in the groups with less than and more than 25 years duration of diabetes.

Name of test	Duration	number	mean	Std.dev	p.value
SC	<25 yrs	28	10.4500	2.65797	0.784ns
	>25 yrs	22	10.6500	2.40471	
BUN	<25 yrs	28	155.6429	46.20343	0.337ns
	>25 yrs	22	167.6364	39.52642	
UP	<25 yrs	28	2.8194	0.2467	0.01hs
	>25 yrs	22	2.9143	0.3214	
SBP	<25 yrs	28	149.5000	23.02092	0.001vhs
	>25 yrs	22	172.7273	21.08979	
DBP	<25 yrs	28	88.2143	8.42112	0.001vhs
	>25 yrs	22	100.0909	8.93313	

When the RFT parameters were compared among the 3 groups (Group I, Group II & group III), Serum creatinine, blood urea nitrogen & urinary protein showed a highly significant increase (Table: 4; p<0.01). The respective parameters in Group I was significantly higher compared to group II (p<0.001) and when compared to Group III. In group II and Group III serum creatinine & blood urea nitrogen showed a Very highly significant difference (p< 0.001) as well as urinary protein showed a highly significant increase (p<0.01). Blood pressure (both systolic & diastolic) did not show any significant difference among the 3 groups.

Table 4: Showing renal function tests parameters in Group I, Group II & Group III.

Name of test	RBS	Number	Mean	Std.dev	p value
SC	<300	10	8.8700	2.21613	0.01hs
	301-359	23	9.5304	1.31855	0.001vhs
	>360	17	12.8824	2.31334	0.001vhs
BUN	<300	10	139.2000	37.47829	0.01hs
	301-359	23	144.7826	25.80338	0.001vhs
	>360	17	195.5294	46.00288	0.001vhs
UP	<300	10	2.1287	0.24481	0.01hs
	301-359	23	2.5124	0.23418	0.01hs
	>360	17	3.0987	0.45679	0.001vhs
SBP	<300	10	151.8000	13.61209	0.624ns
	301-359	23	165.1304	23.79325	0.512ns
	>360	17	157.0588	30.36542	0.325ns
DBP	<300	10	94.2000	9.16273	0.814ns
	301-359	23	93.7391	9.46389	0.736ns
	>360	17	92.5882	12.70364	0.915ns

**DISSCUSSION:**

The present study was carried out to evaluate the renal damage in patients with long standing diabetes mellitus. Renal function tests revealed progressive increase in the serum creatinine, BUN and urinary protein. The increase was

more in those patients with higher RBS and those who are diagnosed to have diabetes for a longer duration. Studies conducted for individual tests in diabetes mellitus indicate that blood tests for renal function in early diabetics are indicative of impending renal morbidity in such patients.

Serum creatinine & blood urea nitrogen did not show any significant change in both the groups < 60 yrs & > 60 yrs age groups. From our observation it appears that the age of the patient has no direct implications on the RFT. This is contrary to the findings made by Bojestig M et al [11] who reported a significant and progressive increase in both the above parameters with the age in > 60 years group and hence suggest increased morbidity and mortality of diabetic nephropathy patients after 60 years of age. Urinary protein showed a very highly significant increase in >60 years age group which correlates well with finding of 'Microalbuminuria collaborative study Group UK' [12]. Both systolic and diastolic Blood pressure showed a very highly significant (P<0.001) increase in older age group (>60 yrs) which confirms the finding of other researchers. [13] Urinary protein level did not show any significant difference among the genders in our study which correlates with the study done by Forsblom C.M et al. [14]

Nelson R G et al.[15] suggested that the serum creatinine and BUN were increased with 15 years of diabetes, but in our study we did not observe similar results among the groups even those suffering from diabetes for 25 years. The medical awareness and availability of high quality medical facilities in the region from where the study sample has been collected could be the reason for this difference. Dakshina Kananda District is a centre of education which hosts several educational universities and it is prosperous region with high literacy. Patients who are well informed manage diabetes well and this reduces occurrence of Co-morbid conditions. Availability of high quality Medical advice adds to this. Same observation may not be true for other parts of the country, and this might reflect in the results also.

Urinary protein was increased significantly in > 25 years duration group which suggested that there is a progressive increase in proteinuria with increasing duration of the disease as the disease pathology progresses from microalbuminuria to macroalbuminuria leading to end stage renal disease. In our study both systolic & diastolic blood pressures showed a highly significant increase in > 25 years duration group which is in agreement to the finding of Nelson R.G. et al [15] where significant increase in blood pressure was reported after 30 years of duration.

Higher RBS showed a corresponding increase in the SC, BUN and urinary protein. The linear relationship is highly suggestive of a direct implication of higher RBS causing more renal damage. This is consistent with the findings of Hogema O et al. (10) Both systolic and diastolic blood pressures did not show any significant difference when compared between the 3 groups RBS viz. Group I, Group II, Group III.

**CONCLUSION:**

There is a progressive increase in proteinuria with increasing duration of diabetes (>25 years) leading to end stage renal disease. Thus higher the duration of diabetes mellitus the more are the chances of developing nephropathy and end stage renal disease. In uncontrolled diabetes significant deterioration of renal function was also observed. Thus renal function tests, serum protein and random blood sugar estimation may be routinely done in all diabetic patients which will go a long way in the medical intervention and prevention of development of complications especially Diabetic Nephropathy.

**REFERENCES:**

- D.N.S Kerr, Chronic Renal Failure. Cecil-Loeb textbook of medicine 1971; 1145-1146
- Mani MK. Patterns of renal disease in indigenous populations in India. Nephrology 1998; 4: S4-S7.
- Kofoed-Enevoldsen A, Borch-Johnsen K, Kriener S, et al. Declining incidence of persistent proteinuria in type I (insulin dependant) diabetic patients in Denmark. Diabetes 1983;36:205-209.
- Orchard TJ, Dorman JS, Fraser RE, et al. Prevalence of complications of diabetes in IDDM by sex and duration. Diabetes 1990;39:1116-1124.
- Diabetes Control and Complications Trial (DCCT) Research Group. Effect of intensive therapy on the development and progression of diabetic nephropathy in the Diabetes Control and Complications Trial. Kidney Int 1995;47:1703-1720.
- Perkins B, Ficociello LH, Silva KH, et al. Regression of microalbuminuria in type I diabetes. N Engl J Med 2003;348:2285-2293.
- Adler AI, Stevens RJ, Manley SE, et al. Development and progression of diabetic nephropathy in type II diabetes. The united Kingdom Prospective Diabetes Study (UKPDS 64). Kidney Int 2003;63:225-232.
- Gall MA, Hougaard P, Borch-Johnsen K, et al. Risk factors for the development of incipient and overt diabetic nephropathy in patients with non insulin dependant diabetes mellitus. BMJ 1997;314:783-788.

9. Viswanathan V, Snehalatha C, Shina K, Lalitha S, Ramachandran A. Familial aggregation of diabetic kidney disease in Type 2 diabetes in South India. *Diabetes Res Clin Pract* 1999; 43: 167-171
10. Hogeman O, Grosjean A, et al. Renal function tests in diabetic nephropathy. *BMJ* 1968;78:213-229.
11. Bojestig M, Amquist HJ, Hermanssen G, et al. Declining incidence of nephropathy in insulin dependant diabetes mellitus. *N Engl J Med* 1994;330:15-18.
12. Microalbuminuria Collaborative Study Group UK. Intensive therapy and progression to clinical albuminuria in patients with insulin dependant diabetes and microalbuminuria. *BMJ* 1995;311:973-977.
13. Hovind P, Tarnow L, Rossing K, et al. Decreasing incidence of severe diabetic microangiopathy in type I diabetes. *Diabetes Care* 2003;26:1258-1264.
14. Forsblom CM, Groop PH, Groop LC. Predictive value of microalbuminuria in patients with insulin dependent diabetes of long duration. *BMJ* 1992;305:1051-1053.
15. Nelson RG, Meyer TN, Myers BD, et al. Course of renal disease in Pima Indians with NIDDM. *Kidney Int* 1997;52 (Supplement 63):S45-S48.

**Source of support: Nil, Conflict of interest: None Declared**