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Research Article

AN ESTIMATION OF GLOMERULAR FILTRATION RATE IN THE DIAGNOSIS AND STAGING OF CHRONIC KIDNEY DISEASE IN PATIENTS WITH TYPE2 DIABETES MELLITUS

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A B S T R A C T

Background: Diabetes mellitus is a leading cause of morbity. The present study intends to stage chronic kidney disease with reference to estimated GFR in type 2 Diabetes.
Aims and Objective: To assess the risk of developing associated microvascular complications in stages of chronic kidney disease with coexisting risk factors.
Material Methods: This prospective study was conducted on 50 cases of type 2 diabetes mellitus patients with chronic kidney disease and 50 normal patients as control. All relevant investigations were done in Departments of Biochemistry, Ophthalmology and Radiology of RIMS, Ranchi.
Results: Out of 50 patients in study group,66% were in stage 4 CKD, 20% in stage 5 and 14% in stage 3 CKD. The risk of diabetic neuropathy was observed to increase as stages of CKD progresses.
Conclusion: The duration of diabetes mellitus showed a strong correlation with progression in the stages of CKD.

INTRODUCTION

Diabetes mellitus refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. The metabolic dysregulation associated with diabetes mellitus causes secondary pathophysiologic changes in multiple organ system that impose tremendous burden on individual with diabetes and on health care system. Diabetes is referred as an "iceberg disease" which is a major health problem that is associated with significant morbidity and mortality.[1]

As per the estimate made by the International Diabetes Foundation, out of 285 million adult diabetic subjects in the world, 70 % live in low and middle economic countries and of these 90% have type 2 diabetes mellitus.[2] The global figure of people suffering from diabetes is estimated to rise from the current estimate of 150 million to 300 million in 2025.Among this the greatest increase will be in India from 19 million in 1995 to 57 million in 2025.[3]

Type 2 Diabetes mellitus is the most common type of diabetes in the world constituting 90% of the diabetic population. The global prevalence of type 2 DM is estimated to increase from 4% in 1995 to 5.4% by the year 2025.[4] The prevalence of type 2 DM is 2.4% in rural and 11.6% in urban population of India.[5]

Diabetic kidney disease (DKD), defined as an elevated albuin excretion rate in a person with DM, occurs in 20% to 40 % of patients with DM and is the leading cause of CKD and end stage renal disease (ESRD) in the United States .[6,7]

Nearly 30% of chronic renal failure in India is due to diabetic nephropathy. In response to the growing prevalence of DKD and DM, which is increasingly recognized as an epidemic, the American Diabetes Association and the National Kidney Foundation have advocated annual screening for DKD in patients with DM by measuring their serum creatinine and albuminuria levels.[8,9] Diabetic nephropathy is now among the most common causes of end stage renal failure. The earliest evidence of nephropathy is microalbuminuria. DM has long been identified as a cardiovascular disease risk equivalent, only recently has CKD been more widely recognized as an independent risk factor for CVD.

Hence, the present study intends to stage chronic kidney disease with reference to estimated GFR in type 2 Diabetes and also to assess the risk of developing associated microvascular complications in stages of chronic kidney disease with coexisting risk factors.

MATERIALS AND METHODS

This prospective study was done on 100 patients attending outpatient clinic or undergoing inpatient treatment at Department of Medicine, Rajendra Institute of Medical Sciences (RIMS), Ranchi between October 2013 and October 2014 were included in the study. Prior to the start of the study a written informed consent was taken from the patients. The patients with age group 40 -80 years and having diagnosed as chronic kidney disease secondary to type 2 diabetes mellitus were included in the study.

Patients not giving consent and having diagnosed to have CKD as a result of other causes then that of Type 2 DM,

patient of CKD dependent on dialysis and patient below 18 years of age were excluded from the study.

A total of 100 patients were included in the study of which 50 patients were with chronic kidney diseases secondary to type 2 DM (as per NKFDOQI guidelines). And 50 patients as control .The control group was selected from healthy individuals from medical student, doctors, medical staff, nursing staff who were healthy and not suffering from diabetes, hypertension or any other diseases. In both study and control group age range was from 40-80 years.

All relevant investigations were done in Department of Biochemistry, Pathology, Ophthalmology and Radiology of RIMS, Ranchi.

Patients were considered to be diabetic based on WHO criteria for diagnosis of DM.

The diagnostic criteria for diabetes include:

1. Symptoms of diabetes plus random blood sugar concentration > 11.1 mmol/1 [200mg/dl]
2. Fasting plasma glucose >70 mmol/1 [126mg/dl]
3. $Hb_A1C > 6.5\%$
4. Two hour plasma glucose > 11.1 mmol/1 (200mg/dl) during an oral glucose tolerance test (Alvin C Powers, 2012)[9]

Estimation of GFR was done by the Cockroft Gault Equation 1976 (based on serum creatinine)[14]

For male:

$$Ccr\ (ml/mt) = \frac{(140 - age) \times body\ weight}{72 \times serum\ cretinine}$$

For female:

$$Ccr\ (ml/mt) = \frac{(140\text{-}age) \times body\ weight}{72x\ serum\ creatinine} \times (0.85)$$

A detailed history, physical examination and investigations were recorded in a proforma after informed consent. The data was collected, tabulated and significance was drawn after applying appropriate statistical tests like frequencies, cross tabs, Chi- square test and one way ANOVA and standard error of difference between two proportions. All the statistical methods were carried out through the SPSS 16.

Table 1 Age Distribution of Patients in Study and Control Group

Age group (Years)	CKD Patients (Study group)		Control Group	
	Number of cases(N)	Percentage(%)	Number of cases(N)	Percentage (%)
40-50	14	28	20	40
51-60	18	36	20	40
61-70	10	20	8	16
71-80	8	16	2	4
Total	50	100	50	100

Table 2 Gender distribution of population

Gender	CKD Patients (Study group)		Control Group	
	Number of cases(N)	Percentage(%)	Number of cases(N)	Percentage (%)
Males	25	50	32	64
Females	25	50	18	36
Total	50	100	50	100

Table 3 Staging of CKD with reference to estimated GFR in Type 2 DM

Stages	Number of cases(N)	Percentage(%)
3	7	14
4	33	66
5	10	20
Total	50	100

Table 4 Diabetic Retinopathy in Stages of CKD

CKD Stages	Normal	NPDR	PDR
3	3	4	0
4	7	24	2
5	0	3	7
Total	**10**	**31**	**9**

NPDR- Non-proliferative diabetic retinopathy
PDR- Proliferative diabetic retinopathy

Table 5 Peripheral Neuropathy in stages of CKD

Stages	No	Yes
3	5	2
4	15	18
5	1	9
Total	**21**	**29**

Table 6 Association of other risk factors in stages of CKD

Risk factors	p- value
Hypertension	0.095
Smoking	0.216
Alcoholism	0.739
Obesity	0.923
Anaemia	0.168
Hypercholestremia	0.165

RESULT

A total of 100 patients were included in the study, of which 50 patients were the case study group with chronic CKD secondary to type 2 DM and the other 50 patients were as control.

The age of both groups ranged between 40 and 80 years. The mean age of study population was 58.5± 10.38 with majority of patients belonged to 51-60 years age group.In study group, there were 14 (28%) patients in the 40-50 years age group. In the control group, there were 20(40%) patients in the 40-5 years age group. Mean age of the study population 55.4±8.64.The age of both the groups were comparable and statistically not significant. (p=0.119).(Table1)

In Table 2, the study group of 50 patients in CKD group, 25 were males(50%) and 25 were females (50%).In control group 32 were male (64%) and 18 were female (36%).

No patients in the study group belong to stages 1 and 2. A maximum number of patients were in stage 4 and the least number of patients in stage 3.(Table 3)

Out of 50 patients studied, 40 had diabetic retinopathy changes, 10 had normal fundus, 31 patients had non proliferative diabetic retinopathy and 9 had proliferation diabetic retinopathy. The association of Diabetic retinopathy with stages of CKD was statistically significant (p=0.000). (Table 4)

In the present study, out of 50 patients studied 29 had features of peripheral neuropathy. Out of 10 patients in stage 5 CKD, 9 had peripheral neuropathy. The association of peripheral

neuropathy with stages of CKD was statistically significant (p=0.032).(Table 5)

In Table 6 shows the association of CKD with other risk factors like HTN, smoking, alcoholism, obesity, anaemia and hypercholestremia. There was statistically non significant association found with these risk factors and CKD.

DISCUSSION

In the present study the mean age of study group was 58.5±10.38 which is similar to other studies.[10,11]

In the present study the gender distribution was consistent with other studies.[12,13.]

Estimated GFR was calculated as per Cockroft Gault Equation (1976)[14]. In the present study out of 50 patients of study group 14% were in stage 3; 66% in stage 4 and 20 % in stage 5 CKD.None of them were in stages 1 and 2 CKD. This was probably because elevated renal function test was taken as major criterion for including patients in the present study. This shows that abnormalities in imaging studies even in the presence of normal renal function test can be taken as criterion for diagnosing CKD.In the study maximum number of patients were in stage 4 CKD, which is not consistent with other studies.[11-13] This may be probably because of difference in the sample population.

The percentages of patients affected with retinopathy in each stage are comparable to other study.[13] The prevalence of retinopathy increases from stage 3-5 in all studies.

The percentages of individualsin stages of CKD with peripheral neuropathy in the present study is comparable to other study.[13]

The risk of diabetic retinopathy was observed to increase as stages of CKD progresses.

However there are a few limitations of the present study as this study ia a hospital based study and the results could not be equated to that of general hospitals. As none of the patients were in stages 1 and 2 of CKD. So comparison with these stage could not be done. Also long term follow up was not possible due to short duration of the study.

CONCLUSION

Microvascular complications like diabetic retinopathy and peripheral neuropathy progresses as stages of CKD progresses. The duration of diabetes mellitus showed a strong correlation with progression in stages of CKD. The risk factors like hypertension and and hypercholestremia are significantly associated with progression of microvascular complications in stages of CKD. However, raised HDL level used to play a favourable role.

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