



TO STUDY THE DIFFERENCE IN ESTIMATED GLOMERULAR FILTRATION RATE (EGFR) AND TOTAL KIDNEY VOLUME (TKV) BETWEEN NEWLY DIAGNOSE DM TYPE 2 AND HEALTHY CONTROL

General Medicine

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ABSTRACT

Material and Method: This was a hospital based observational case control study conducted on 66 diabetics case group and 66 healthy control group. A detailed history and physical examination were recorded. Laboratory investigations done were - fasting and postprandial blood sugar, and glycosylated haemoglobin. eGFR was estimated by the creatinine clearance and TKV was determined by ultrasonography.

Result: The mean eGFR (ml/min) in cases and control was 106.57 ± 10.69 and 92.909 ± 4.62 respectively, which was statistically significant ($p < 0.001$). The mean total kidney volume (ml) in cases and control was 125.81 ± 15.508 and 91.15 ± 3.66 respectively, which was also statistically significant ($p < 0.001$). The eGFR and TKV both were found to be significant in this study.

Conclusion: We observed that newly diagnosed cases of diabetes have significantly higher eGFR and total kidney volume as compared to non-diabetic healthy population. Hence eGFR and total kidney volume can be predicted to a certain degree, i.e. there is a gradual developing diabetic nephropathy.

KEYWORDS

eGFR, TKV and Diabetes.

Introduction:

Diabetes mellitus (DM) is a metabolic cum vascular syndrome of multiple aetiology characterised by chronic hyper-glycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defect in insulin secretion, insulin action or both resulting into changes in small blood vessels (micro angiopathy) and large blood vessels (macro angiopathy). Diabetic nephropathy has been categorized into stages: micro-albuminuria and macro-albuminuria. The cut-off values of micro- and macro-albuminuria are arbitrary and their values have been questioned. Diabetic nephropathy screening is made by measuring albumin in spot urine. Additionally, it is recommended that glomerular filtration rate can be routinely estimated for appropriate screening of nephropathy, because some patients present a decreased glomerular filtration rate when urine albumin values are in the normal range.

Diabetic nephropathy develops in 20 - 30% of patients with Type-2 diabetes, and 3 - 8% of Type-2 diabetics' progress to end-stage renal disease¹. However, because of the enormous number of diabetics worldwide (135 million in 1995 and an estimated 300 million by 2025²), the total number of cases of diabetic nephropathy is very high. Diabetic nephropathy has been divided temporally into five distinct functional stages: The earliest being a stage of renomegaly and hyper filtration, and the most advanced being end-stage renal disease. The intervening stages are characterised by increasing urinary albumin excretion and decreasing glomerular filtration rate. Renal hypertrophy and hyperplasia are characteristic features of early renal involvement in Type-1 diabetes and are present for many years till decline in GFR begins.

Similar findings in Type-2 diabetes have not been documented by many workers. They precede the onset of micro-albuminuria by many years but often go unrecognised. Hyper filtration and renomegaly are rarely included in the clinical evaluation of patients because the procedures involved are technically too demanding.

Chronic kidney disease (CKD) is also a significant risk factor for vascular disease and early cardiovascular mortality as well as progression of kidney disease.³

Measurement of bipolar renal length is traditionally regarded as an initial requirement during sonographic examinations of patients with suspected renal impairment⁴ because reduced renal length is considered an indicator of irreversible chronic renal disease. Accordingly, renal length measurements should be reliable and

repeatable, but they are subject to substantial inter observer and intra observer variability⁵.

The present study has been undertaken to find out the difference in eGFR and TKV between newly diagnosed Type-2 diabetes and matched healthy control.

MATERIAL AND METHODS

The present observational case control study was conducted at Upgraded Department of Medicine, S.M.S Medical College & Hospital, Jaipur over one year duration. After taking informed consent and clearance from institutional ethical committee, 66 cases of recently diagnosed diabetes mellitus type 2 and 66 healthy control were enrolled in study with age and sex matched.

INCLUSION CRITERIA

1. Patients between 35-60 years of age
2. Newly diagnosed DM type 2 patients
3. Without prior Hypertension
4. Without evidence of retinopathy
5. Without Non-diabetic Renal Disease.

EXCLUSION CRITERIA

1. Patients requiring insulin to control their diabetes (type 1 DM).
2. Patients with High Serum Creatinine (more than 1.3 mg/dl for men and more than 1.1 mg/dl for women).
3. Patients with UTI.
4. Patients taking angiotensin converting enzyme inhibitors. Complete socio-demographic information was taken and laboratory data were obtained. These include fasting and post-prandial blood sugar, and glycated haemoglobin.

- eGFR was estimated by Cockcroft-Gault equation and TKV was determined by ultrasonography.

- Total Kidney Volume (TKV) was measured by ultrasound estimation of the length, antero-posterior, and transverse diameters of the kidney. A single observer conducted all the measurements. The renal volume was calculated based on the equation for a 3-dimensional ellipsoid

$$Vk = \pi LWD/6$$

Where: L = Length of the kidney

W = Width or transverse diameter of the kidney

D = Depth or antero-posterior diameter of the kidney

For a given patient, volumes of both kidneys were measured and the mean of both values was the TKV.

- eGFR was estimated by : Cockcroft - Gault equation

$$\text{Estimated creatinine clearance (ml/min)} = \frac{(140 - \text{age}) \times \text{body weight (kg)}}{72 \times \text{Scr (mg/dL)}} \\ (\text{Multiply by 0.85 for women})$$

STATISTICAL ANALYSIS

Continuous data was summarized in form of mean and S.D. The difference in means were analysed by using students T test. Counted data was expressed in form of proportion. The difference in proportion was analysed using chi-square test and correlation analyses by using pearson's correlation coefficient. The level of significance was kept 95% for all statistical analysis.

OBSERVATIONS AND RESULTS

The 66 cases in each group were included after age and sex matched.

Table1 showed baseline parameters of case and control groups:-

Table1: Baseline parameters of case and control group

	Case		Control		p value
	Mean	St.deviation	Mean	St.deviation	
FBS	177.92	14.36	79.24	6.172	0.001 (S)
PPBS	273.63	22.97	103.21	9.06	0.001 (S)
HbA1c	9.601	1.36	4.84	0.47	0.001 (S)
SBP	119.48	10.82	119.62	8.75	0.902 (NS)
DBP	77.69	6.57	79.09	6.16	0.21 (NS)

Table 2: Distribution of eGFR (ml/min.) among the study

	N	Mean	Std. Deviation	Minimum	Maximum	P value
Case	66	106.57	10.69	89.39	130.88	0.001 (S)
Control	66	92.909	4.62	84.69	105.75	
Total	132	99.74	10.7	84.69	130.88	

Test applied: unpaired t test.

Table 2&fig1 showed comparison of eGFR among case and control groups which was statistically significant (p<0.001)

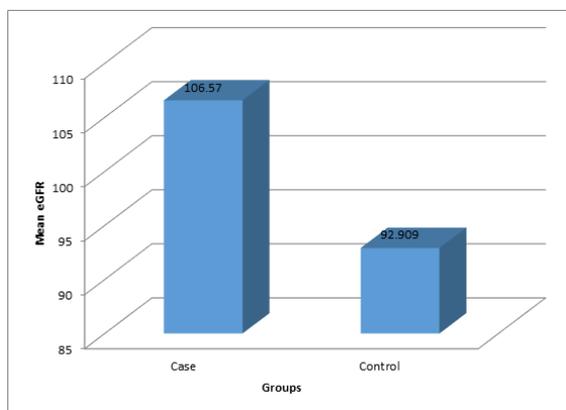


Figure 1

Table 3: Distribution of TKV (ml) among the study

	N	Mean	Std. Deviation	Minimum	Maximum	P value
Case	66	125.81	15.508	100.38	164.56	0.001 (S)
Control	66	91.15	3.66	82.29	99.97	
Total	132	108.48	20.701	82.29	164.56	

Test applied: unpaired t test.

Table3 & fig2 showed comparison of TKV among case and control groups which was statistically significant (p<0.0)

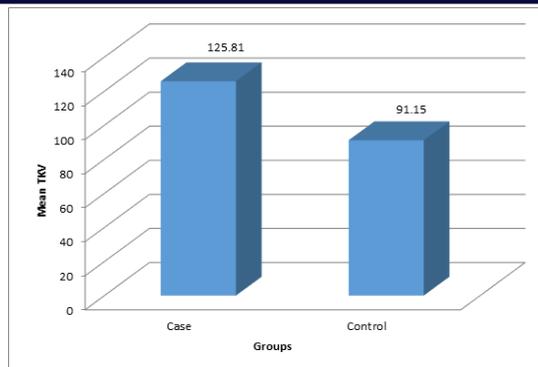


Figure 2

DISCUSSION

Diabetic nephropathy develops in 20 -30 % of patients with type-2 diabetes and 3-8 % of type 2 diabetics progress to end stage renal diseases. Diabetic nephropathy has been divided temporally into five distinct functional stages. The earliest being a stage of renomegaly and hyperfiltration and the most advanced are being end stage renal disease. The intervening stages are characterised by increasing urinary albumin excretion and decreasing glomerular filtration rate. Renal hypertrophy and hyperplasia are characteristic findings in type 2 diabetes precede the onset of microalbuminuria by many years but often go unrecognised.

The present study was conducted in the upgraded department of medicine, SMS Medical college and attached group of hospital, Jaipur. The purpose of this study is to determination of estimated glomerular filtration rate and total kidney volume to document hyperfiltration and renomegaly in newly diagnosed noninsulin type 2 diabetes cases and healthy person.

In this study we found significantly higher mean eGFR 106.57 ± 10.69 ml/min in newly diagnosed type-2 diabetic patients as compared to age and sex matched healthy control 92.909 ± 4.62 ml/min (p=.001). MYERS BD et al⁶ in 1991 similarly reported significantly higher mean eGFR 140 ± 6 ml/min in diabetic group as compared to control 122 ± 5ml/min (p<0.01). VORA JP et al⁷ in 1992 reported significantly higher mean eGFR 117 ± 22 ml/min in diabetic cases as compared to control 95 ± 12 ml/min (p<.001). KELLER CK et al⁸ in 1996 similarly reported mean eGFR of 136 ml/min in diabetic cases and 131 ml/min in control group with statistically significant difference (p<.001). A K Agarwal et al⁹ in 2005 reported significantly higher mean eGFR 110.28 ml/min in newly diagnosed type 2 diabetic cases as compared to control 91.55 ml/min(p=.031). RAYMOND BRUCE et al¹⁰ similarly reported significantly higher mean eGFR 165.6ml/min in recently diagnosed diabetic cases as compared to control 119.6ml/min (p<0.001). The results of our study are in concordance with the results of the above mentioned studies.

In this study we found significantly higher mean total kidney volume 125.81± 15.508 ml in newly diagnosed type-2 diabetic patients as compared to age and sex matched control 91.15 ± 3.66 ml(p<.001). MARCELLO MANCINI et al¹¹ in 2013 similarly reported significantly higher mean TKV 197 ± 47.6 ml in diabetic group as compared to control 162.5 ± 35.2 ml (p<.0001).Our result was supported by study done by A K Agarwal et al⁷ who found significantly higher mean TKV 140.68 ml in newly diagnosed type-2 diabetic cases as compared to control group 91.72 ml (p<.01).

CONCLUSION

From this observational case control study, it can be concluded that newly diagnosed cases of diabetes have significantly higher eGFR and total kidney volume as compared to non- diabetic healthy population. So, if there is an increase in the eGFR or TKV of a patient as compared to his baseline after the development of diabetes, it can be predicted to a certain degree, that there is gradually developing diabetic nephropathy. Thus, if a proper intervention is carried out at this early stage, the progression to end stage renal disease can be curtailed.

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