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To study Correlation of eGFR and TKV with HbA1c and micro-albuminuria in newly diagnosed DM type 2 case and other variables of these parameters known to be associated with diabetic nephropathy.

General Medicine

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ABSTRACT

Aim: To determine Correlation of eGFR and TKV with HbA1c and micro-albuminuria in newly diagnosed DM type 2 and other variables of these parameters known to be associated with diabetic nephropathy.

Methods: This was an hospital based observational case study. Total 66 newly diagnosed DM type 2 cases were included in this study. A detailed history and physical examination were recorded. The following laboratory investigations were done - fasting and postprandial blood sugar and glycosylated haemoglobin. Micro-albuminuria was tested in urine using clinitek microalbumin test strips. GFR was estimated by the creatinine clearance and TKV was determined by ultrasonography.

Result: In this study a significant correlation was found between eGFR with micro-albuminuria, fasting blood sugar ($p<0.001$), post prandial blood sugar ($p<0.001$) and glycosylated Hb ($p= .03$) but non- significant correlation was found between eGFR with SBP ($p=0.57$) , DBP($p=0.77$) and TKV ($p= 0.08$). Also non- significant correlation was found between TKV with micro-albuminuria, SBP ($p=.16$), DBP ($p=.55$), FBS ($p=.06$), PPBS ($p=.42$) andHbA1C ($p=.99$).

Conclusion: We observed a significant correlation between eGFR with micro-albuminuria, fasting blood sugar, post prandial blood sugar and glycosylated Hb but non- significant correlation was found between eGFR with SBP, DBP and TKV but total kidney volume did not have any significant correlation with hypertension (SBP and DBP) and glycaemic control (FBS, PPBS and HbA1C) in newly diagnosed type 2 diabetic case. Hence concluded that early renal changes had correlation with the risk factors for diabetic renal disease and proper control of parameters can bring about significant reduction in development of diabetic nephropathy.

KEYWORDS

Diabetes, eGFR, TKV

Introduction:

Prevalence of type 2 diabetes mellitus (T2DM) is increasing globally and has reached epidemic proportions in many countries. The recent estimates by the International Diabetes Federation (IDF) showed that the number of adults affected by the disease in 2011 were 366 million which was projected to increase to 552 million by 2030[13]. The pre-diabetic stages also carry high risk for cardiovascular diseases (CVDs) and clustering of the cardiovascular risk factors or the metabolic syndrome.[1,2]

Among the top 10 countries/territories with the largest number of diabetic adults, five are in Asia.[2] India is largely a rural nation and the recent available reports indicate rising prevalence of the disease in the rural areas as well.[3,4]

In parallel with the increase in diabetes, a dramatic increase in the prevalence of diabetic nephropathy has been noted,[5,6] which has become the single most common cause of end-stage kidney disease according to some,[7,8]but not all,[9] reports. In the elderly, diabetic nephropathy today accounts for no less than 46% of chronic kidney disease.[10] In the "Chennai Urban Rural Epidemiology Study," the prevalence of overt nephropathy and micro-albuminuria were 2.2% and 26.9%, respectively, in the urban citizens with diabetes,[11] The estimated overall incidence rate of chronic kidney disease (CKD) and end-stage renal disease (ESRD) in India is currently 800 per million population and 150–200 pmp, respectively.[6]

Diabetic nephropathy has been categorized into two stages: micro-albuminuria and macro-albuminuria.

Diabetic nephropathy screening is made by measuring albumin in spot urine. In addition, it is also recommended that glomerular filtration rate 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 diabetic progress to end-stage renal disease[12]. However, because of the enormous number of diabetics worldwide (135 million in 1995 and an estimated 300 million by 2025[13]), 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.

In Type-2 diabetes have been documented the onset of micro-albuminuria by many years but often go unrecognised. There have been few studies which have tried to relate these early renal changes with the risk factors for diabetic renal disease, e.g., glycaemic control, micro-albuminuria, and blood pressure.

The present study has been undertaken to find out the earliest stage of diabetic renal disease in Type-2 diabetes by measuring eGFR and TKV by simpler and non-invasive methods. The present study has been undertaken to find out the earliest stage of diabetic renal disease in Type-2 diabetes by measuring eGFR and TKV and Correlation of these parameters with other variables known to be associated with diabetic nephropathy.

Aims & objectives:

To determine correlation of eGFR and TKV with HbA1c and micro-albuminuria in newly diagnosed DM type 2 cases and other variables of these parameters known to be associated with diabetic nephropathy.

Material and Methods:-

This was an hospital based observational case study conducted on **66** cases of recently diagnosed diabetes mellitus type 2 at Upgraded Department of Medicine, S.M.S Medical College & Hospital, Jaipur, after approval from research review board.

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 and type 1 diabetes.
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.

Plan of Action:

Patients diagnosed with recent onset diabetes type 2 and fulfilling the inclusion and exclusion criteria were included in the study. Complete socio-demographic information was taken and laboratory data include fasting and post-prandial blood- sugar, and glycated haemoglobin were obtained. Micro-albuminuria was tested in urine using clinitek micro-albumin test strips. eGFR was estimated by Cock croft-gault equation and TKV was determined by ultrasonography.

- Total Kidney Volume (TKV) was measured by ultrasound estimation of the length, anterior-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 anterior-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 Estimated creatinine clearance (ml/min) = (140-age) x body weight (kg) 72 x Pcr (mg/dL) Multiply by 0.85 for women.

Statistical Analysis:

Continuous data was summarized in the form of mean and S.D. The difference in means were analysed by using students T test. Counted data was expressed in the 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.

Results:

Total 66 diabetic cases were included in study and observed:-

Table 1: Distribution of eGFR (ml/min.) according to micro-albuinuria (mg/g)

	Micro-albuminuria	N	Mean	Std. Deviation	P value
Case	30-300	21	111.71	9.21	0.0068
	<30	45	104.19	10.58	

Table1 showed comparison of eGFR according to micro-albuminuria among groups. Micro-albuminuric case showed more mean eGFR as compared to normoalbuminuric cases which had statistically significant results.

Table 2: Distribution of TKV (ml) according to microalbuminria (mg/g)

	Micro-albuminuria	Mean	Std. Deviation	P value
Case	30-300	128.55	16.92	0.330
	<30	124.53	14.82	

Table2 showed comparison of TKV according to micro-albuminuria among groups. Micro-albuminuric cases showed slightly more mean score of TKV as compared to normoalbuminuric cases which had statistically non-significant results.

Table 3: correlation in eGFR and TKV with variable parameters

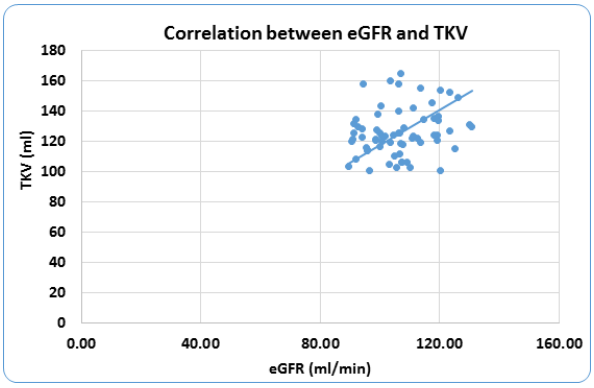
		eGFR		TKV	
	Mean ±SD	Mean ±SD	P value	Mean ± SD	P value
SBP	119.48±10.82	106.57±10.69	0.57(NS)	125.81±15.508	0.16(NS)
DBP	77-69±6.57	106.57±10.69	0.77(NS)	125.81±15.508	0.55(NS)
FBS	177.92±14.36	106.57±10.69	<0.001(S)	125.81±15.508	0.66(NS)
PPBS	273.63±22.97	106.57±10.69	<0.001(S)	125.81±15.508	0.42(NS)
HbA1c	9.601±1.36	106.57±10.69	0.03(S)	125.81±15.508	0.99(NS)

Table 3 showed significant correlation between eGFR with micro-albuminuria, fasting blood sugar ($p<0.001$), post prandial blood sugar ($p<0.001$) and glycosylated Hb ($p= .03$) but non- significant correlation between eGFR with SBP ($p=0.57$), DBP ($p=0.77$) and TKV ($p= 0.08$). Also non- significant correlation was found between TKV with micro-albuminuria, SBP ($p=.16$) DBP ($p=.55$),FBS ($p=.06$), PPBS ($p=.42$) andHbA1C ($p=.99$).

Table 4: Correlation between eGFR and TKV

	Mean	Std. deviation	R	R square	P value
TKV	125.81	15.508	0.21	0.04	0.08
eGFR	106.57	10.69			

Table 4 & fig.1 showed correlation between eGFR and TKV among the study. eGFR and TKV didn`t showed significant correlation with each other's ($p=0.08$) where r value=0.21.



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 hyper-filtration and the most advanced being an end stage renal disease. The intervening stages are characterised by increasing urinary albumin excretion and decreasing glomerular filtration rate.

There have been few studies which have tried to relate early renal changes with the risk factors for diabetic renal disease e.g. glycaemic control, micro-albuminuria and blood pressure. 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 determine correlation of estimated glomerular filtration rate and total kidney volume with other variables known to be associated with diabetic nephropathy in newly diagnosed type 2 diabetes cases.

In this study we found significantly higher mean eGFR in 21 micro-albuminuric type 2 diabetic cases(111.71 ± 9.21ml/min) as compared to 45 normoalbuminuric cases(104.19 ± 10.58 ml/min) ($p=.0068$). TANIWAKI H et al[14] in 2000 similarly reported. We found no significant difference in mean TKV in 21 micro-albuminuric type 2 diabetic cases (128.55 ± 16.92 ml) as compared to 45 normoal buminuric cases (124.53 ± 14.82 ml) ($p = 33$).

In this study, the eGFR was significantly correlated with the fasting blood sugar in newly diagnosed type-2 diabetic patients, this is in agreement with the findings of A K Agarwal et al[15] where eGFR in 25 newly diagnosed type 2 diabetics was significantly correlated with fasting blood glucose ($r=0.4$ and $p=.048$). Rohitash K. et al[16] similarly reported significantly positive correlation between eGFR and fasting

blood sugar ($p<0.001$) in 25 freshly diagnosed case of type-2diabetes. Yasuyuki Jin Tatsumiy et al[17] in 2006 also reported significantly positive correlation between eGFR and fasting blood sugar ($p<0.001$).

In this study, the eGFR was significantly correlated with the postprandial blood sugar in newly diagnosed type 2 diabetic cases, this is in agreement with the finding of Rohitash K.et al[16] where eGFR significantly correlated with post prandial blood sugar ($p<0.0001$).

In this study ,eGFR was significantly correlated with the glycosylated Hb (HbA1C) in newly diagnosed type 2 diabetic cases, this is in agreement with the finding of Vincent Rigalleaur et al[18] in 2006 where eGFR in 193 diabetic patients was significantly correlated with HbA1C ($r= 0.26$ and $p<0.001$). A K Agarwal et al[209] reported significantly correlation between eGFR and HbA1C ($p<0.05$) in diabetics of duration less than 1 year, not in newly diagnosed diabetics.

In this study eGFR was not significantly correlated with SBP and DBP in newly diagnosed type 2 diabetic cases, this is in agreement with the finding of Tarek El Baz et al[19] 2013 where eGFR in 300 diabetic type 2 patient was not significantly correlated with SBP ($r=.017$ and $p>0.05$) and DBP ($r=.012$ and $p >.05$). A K Agarwal et al[15] also reported no significant correlation between eGFR and SBP ($r=.22$ and $p>.05$) and DBP ($r=.39$ and $p>0.05$).The lack of an association of eGFR with blood pressure in our study could be due to rather strict selection criteria, whereby we excluded all previously known hypertensive and those taking anti-hypertensive drugs. The population of type-2 diabetics in our study was relatively younger.

In this study eGFR was not significantly correlated ($r=.21$ and $p=0.08$) with total kidney volume(TKV) in newly diagnosed type 2 diabetic cases this is in agreement with the finding of SCHMITZ A et al[20] 1989 where eGFR in 18 diabetic type 2 case was not significantly correlated with TKV ($r=.40$ and $p=0.10$).

A K Agarwal et al[15] reported significantly correlation between eGFR and TKV in diabetics with duration <1 year ($r=.673$ and $p<0.01$) but not in newly diagnosed type 2 diabetic cases.

In this study total kidney volume did not have any significant correlation with hypertension (SBP and DBP) and glycemic control (FBS, PPBS and HbA1C) in newly diagnosed type 2 diabetic case. This is in agreement with the findings of A K Agarwal et al[15] 2005 where TKV was not significantly correlated with hypertension, glycaemic control and micro-albuminuria. ANITA M.SARAN et al[21] 2007 also reported no significant correlation between TKV and SBP ($r=.02$ and $p=.80$), TKV and DBP ($r=-.04$ and $p=.58$), TKV and micro-albuminuria ($r=.14$ and $p=.07$) in type 2 diabetic case.

Conclusion:

From our present observational study, it can be concluded that newly diagnosed cases of diabetes which had micro-albuminuria had comparatively higher eGFR as compared to those diabetic patients who had not developed micro-albuminuria in spite of having similar total kidney volumes. An important observation was made when it was found that eGFR was significantly affected by fasting blood sugar, postprandial blood sugar and glycosylated haemoglobin levels.

Development of micro-albuminuria has traditionally been known to be a harbinger of diabetic nephropathy. As in our study it was observed that diabetic patients with and also without micro-albuminuria had significantly higher eGFR and TKV compared to non-diabetics. Hence eGFR and TKV can also be used as parameters to detect development of early diabetic nephropathy. 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 he is gradually developing diabetic nephropathy. Thus, if proper interventions as carried out at this early stage, the progression to end stage renal disease can be curtailed.

Since eGFR was found to be correlated significantly with FBS, PPBS and HbA1c, proper control of the glycaemic parameters can bring about significant reduction in the increment of eGFR and thus the development of diabetic nephropathy.

References

1. Agarwal SK, Srivastava RK. Chronic kidney disease in India: Challenges and solutions. Nephron Clin Pract. 2009;111:c197–203.
2. Jha V. Current status of end-stage renal disease care in South Asia. Ethn Dis. 2009;19:S1-27–32.
3. Modi GK, Jha V. The incidence of end-stage renal disease in India: A population-based study. Kidney Int. 2006;70:2131–3.
4. Agarwal HK, Yashodara BM, Nand N, Sonia, Chakrabarti D, Bharti K, et al. Spectrum of renal disorders in a tertiary care hospital in Haryana. J Assoc Physicians India. 2007;55:198–202.
5. Prakash J, Hota JK, Singh S, Sharma OP. Clinical spectrum of chronic renal failure in the elderly: A hospital based study from eastern India. Int Urol Nephrol. 2006;38:821–7.
6. Unnikrishnan RI, Rema M, Pradeepa R, Deepa M, Shanthirani CS, Deepa R, et al. Prevalence and risk factors of diabetic nephropathy in an urban South Indian population: The Chennai Urban Rural Epidemiology Study (CURES 45) Diabetes Care. 2007;30:2019–24.
7. American Diabetes Association: Diabetic Nephropathy (Position statement). Diabetes Care 2000; 23 (Suppl 7): 569-72.
8. King H, AuBert RE, Herman WH. Global burden of diabetes, 1995-2025: prevalence, numerical estimates, and projections. Diabetes Care 1998; 21 (9): 1414-31.
9. Taniwaki H A , Ishimura E.A., Emoto M.A., Kawagishi T.A, Matsu
10. AK Agarwal, Sumeet Singla, Umesh Garg, Rajbala Yadav, Sanjeev Miglani, Arun K Jain Glomerular Filtration Rate and Total Kidney Volume in Cases of Recent Onset Type-2 Diabetes Mellitus JIACM 2005; 6(4): 285-90
11. Rohitash Kumar, Rakesh Kumar, Ranjana Mathur, Jairam R. A Study on Renal Function Tests and its Correlation with Blood Glucose and eGFR in Newly Diagnosed Type 2 Diabetes Mellitus J Clin Biomed Sci 2015; 5(2):89-91
12. Yasuyuki Jin Tatsumi, Moriya Yoshikuni Fujita. Glomerular hyperfiltration in non protinuric and non hypertensive Japanese type 2 diabetic patients. Science direct navigation diabetes research and clinical practice march 2006,vol.71(3);264-271,doi:10.1016/j.diabres.2005.06.014.
13. Vincent Rigalleau, Catherine Lasseur, Christelle Raffaitin, Caroline Perlemoine, Nicole Barthe, Pharmd, Philippe Chauveau, Christian Combe, Henri Gin, Glucose Control Influences Glomerular Filtration Rate and Its Prediction in Diabetic Subjects Diabetes Care, Volume 29, Number 7, July 2006
14. Tarek El Baz, Fawzy Hamed, Abdallah Mahmod, Osama Khamis, Amgad Awad and Ayman Abd El-Aziz. Screening for the detection of early decline of renal functions among a group of Egyptian diabetics and hypertensive patients
15. Schuntz A, Christensan T, Taagehoej J F, Glomerular filtration rate and kidney volume in non insulin dependent diabetes lack of glomerular hyperfiltration and renal hypertrophy in uncomplicated NIDDM. Scand J Clin Lab Invest 1989 ; 49 ;103-8
16. Anita M Saran, Fang-Chi Hsu, Kurt K. Lohman, J. Jeffrey Carr, Donald W. Bowden, Lynne E. Wagenknecht and Barry I Freedom Kidney Volume Associations with Subclinical Renal and Cardiovascular Disease: The Diabetes Heart Study Am j Nephrol. 2008 Apr; 28(3): 366–371.