



Original Article

## To Study the Estimated Glomerular Filtration Rate in Patients with Type 2 Diabetes Mellitus at tertiary care centre of western India.: A Hospital based Cross Sectional Study

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Received: 17-09-2025

Accepted: 15-10-2025

Available online: 30-10-2025

### ABSTRACT

**Background:** Diabetic patients are at an increased risk of developing specific complications like nephropathy, retinopathy, neuropathy and atherosclerosis. Diabetic nephropathy is a leading cause of end stage renal damage, characterised by decreased glomerular filtration rate and proteinuria. The morbidity and mortality can be reduced by regular screening, early detection and appropriate treatment of chronic complications.

**Objective of the Study:** To estimate the glomerular filtration rate by using the Modification Of Diet in Renal Disease (MDRD) equation and serum creatinine as method for screening of reduced renal function in type 2 diabetes mellitus patients.

**Materials and Methods:** A total of 30 subjects (of age group 30-60 years) suffering from Type 2 Diabetes Mellitus were selected from medicine outpatient department and inpatient department of government medical college and hospital, tertiary care centre and 30 age and sex matched non diabetic controls were taken. Diabetic patients included were of diabetic duration 5-10 years.

Group 1: 30 non diabetic healthy subjects, of both sexes, of age group 30-60 years.  
Group 2: 30 type 2 diabetes mellitus patients, of both sexes, of age group 30-60 years.

Laboratory investigations done were fasting blood sugar, serum creatinine. eGFR is estimated according to MDRD equation available on website of National Kidney Foundation.

**Result-** Mean age of control group was  $47.77 \pm 1.78$  years and case group was  $46.33 \pm 3.90$  Years. Mean body mass index of controls and cases were  $23.33 \pm 1.96 \text{kg/m}^2$  and  $23.81 \pm 1.80 \text{kg/m}^2$  respectively. Mean fasting blood glucose of controls and cases were  $88.7 \pm 17.29 \text{mg/dl}$ ,  $129.1 \pm 29.59$ , respectively. The creatinine of controls and cases were  $0.83 \pm 0.10 \text{mg/dl}$ ,  $1.42 \pm 0.54 \text{mg/dl}$  respectively. The estimated glomerular filtration rate of cases was  $63.19 \pm 26.49$  and of control group was  $95.46 \pm 19.56$  (ml/min/1.73m<sup>2</sup> and the difference estimated glomerular filtration rate between case and controls were highly significant). ( $p < 0.001$ )

**Conclusion:** eGFR could be estimated when patients are diagnosed as diabetics and at time of follow up annually. Early detection of renal damage may help to delay the process. Good control of blood glucose level is absolute requirement to prevent progressive renal impairment. This study will be very helpful to clinicians to begin necessary medical therapy.

**Keywords:** eGFR, Diabetes, Nephropathy.

## INTRODUCTION

Diabetes mellitus represents one of the most significant public health challenges of the 21st century. As per International Diabetes Federation, There is very high burden of diabetes in India among the other countries, with prevalence steadily increasing over the past two decades [1]. Nearly 90–95% of all diabetes cases accounted to type 2 diabetes mellitus and is strongly associated with sedentary lifestyle, obesity, genetic predisposition, and dietary factors. Microvascular and macrovascular complications are attributed to chronic hyperglycemia. Macrovascular complications include coronary artery disease, cerebrovascular disease, and peripheral vascular disease. Microvascular complications include diabetic retinopathy, neuropathy, and nephropathy. Among microvascular complications, leading cause of chronic kidney disease and end-stage renal failure worldwide is diabetic nephropathy.[2].

There is very complex mechanism that involves in the pathophysiology of diabetic nephropathy. Persistent hyperglycemia leads to formation of advanced glycation end products (AGEs), increased oxidative stress, activation of protein kinase C pathways, and stimulation of the renin-angiotensin-aldosterone system, such events eventually leads to glomerular hyperfiltration in early stages, followed by progressive glomerulosclerosis, basement membrane thickening, mesangial expansion, and eventual decline in glomerular filtration rate (GFR) [3]. Therefore decreased glomerular filtration rate and proteinuria leads to end stage renal damage so by by regular screening, early detection and appropriate treatment diabetic nephropathy morbidity and mortality can be reduced. Therefore, estimation of GFR has become central to early detection strategies [4]. Previous study also concluded that the Modification of diet in renal diseases (MDRD) equation was developed to improve accuracy in estimating renal function. [5] However, regional data from tertiary care centers in North India remain limited. The present study was therefore undertaken to study the Estimated Glomerular Filtration Rate in Patients with Type 2 Diabetes Mellitus at tertiary care.

### Objective of the Study

To estimate the glomerular filtration rate by using the Modification Of Diet in Renal Disease (MDRD) equation and serum creatinine as method for screening of reduced renal function in type 2 diabetes mellitus patients.

### MATERIALS AND METHODS

This was a hospital based cross sectional study done between January 2014 to February 2016. A total of 30 subjects (of age group 30-60 years) suffering from Type 2 Diabetes Mellitus were selected from medicine outpatient department and inpatient department of government medical college and hospital, Aurangabad and 30 age and sex matched non diabetic controls were taken. Diabetic patients included were of diabetic duration 5-10 years. Known chronic kidney disease unrelated to diabetes, acute infections, severe systemic illness were excluded

**Group 1:** 30 non diabetic healthy subjects, of both sexes, of age group 30-60 years.

**Group 2:** 30 type 2 diabetes mellitus patients, of both sexes, of age group 30-60 years.

Laboratory investigations done were fasting blood sugar, serum creatinine. eGFR is estimated according to Modification of diet in renal diseases (MDRD) equation available on website of National Kidney Foundation.

### Modification of diet in renal diseases (MDRD) equation:

$eGFR (mL/min/1.73 m^2) = 186 \times (\text{serum creatinine } [mg\%])^{-1.154} \times \text{age (years)}^{-0.203} \times (0.742 \text{ if female}) \times (1.212 \text{ if black})$ . Three parameters fasting blood glucose, serum creatinine and estimated glomerular filtration rate were estimated and compared. The diabetic subjects were of similar age, height, weight, body mass index to that of non diabetic control. For each parameter, the mean value and standard deviation were calculated. Statistical analysis was done by using Unpaired 't' test to test whether the differences in means were statistically significant. All the calculations and statistics were done using Microsoft Excel 2007. A 'p' value of less than 0.05 ( $p < 0.05$ ) was considered to be statistically significant. A 'p' value of less than 0.001 ( $p < 0.001$ ) was considered to be statistically highly significant.

### RESULTS

Mean age of control group was  $47.77 \pm 1.78$  years and case group was  $46.33 \pm 3.90$  Years. Mean body mass index of controls and cases were  $23.33 \pm 1.96 kg/m^2$  and  $23.81 \pm 1.80 kg/m^2$  respectively. Mean fasting blood glucose of controls and cases were  $88.7 \pm 17.29 mg/dl$ ,  $129.1 \pm 29.59$ , respectively. The creatinine of controls and cases were  $0.83 \pm 0.10 mg/dl$ ,  $1.42 \pm 0.54 mg/dl$  respectively. The estimated glomerular filtration rate of cases was  $63.19 \pm 26.49$  and of control group was  $95.46 \pm 19.56$  (ml/min/1.73m<sup>2</sup>) and the difference of estimated glomerular filtration rate between case and controls were highly statistically significant ( $p < 0.001$ ).

Table 1. Baseline characteristics of Study Groups

Parameters	Study Groups	
	Group 1 (Control) n = 30	Group 2 (Cases) n = 30

	Mean ± SD	Mean ± SD
Age (years)	47.77 ± 1.78	46.33 ± 3.90
Height (cm)	168.10 ± 4.50	169.0 ± 3.69
Weight (kg)	66.03 ± 7.23	68.10 ± 6.63
BMI (kg/m <sup>2</sup> )	23.33 ± 1.96	23.81 ± 1.80

Group 1- non diabetic controls, Group 2- type 2 diabetes mellitus patients n= number of subjects, cm- Centimeter, Kg/m<sup>2</sup>- Kilogram/meter<sup>2</sup>, SD- Standard Deviation

**Table 2. Comparison Of Different Biochemical Parameters Between Study Groups**

Parameters	Group 1 (Control) n = 30 (Mean ±SD)	Group 2(Cases) n = 30 (Mean ±SD)	P value
Fasting Blood glucose(mg/dl)	88.7 ± 17.29	129.1 ± 29.59	<0.001 (HS)
Serum creatinine (mg/dl)	0.83 ± 0.10	1.42 ± 0.54	<0.001 (HS)
eGFR-MDRD (ml/min/1.73m <sup>2</sup> )	95.46 ± 19.56	63.19 ± 26.49	<0.001 (HS)

Group 1- Non diabetic controls, Group 2- Type 2 diabetes mellitus patients, n= Number of subjects, cm- Centimeter, Kg/m<sup>2</sup>- Kilogram/meter<sup>2</sup>, SD- Standard Deviation, HS –Highly Significant

The diabetic group demonstrated significantly higher fasting blood glucose and serum creatinine levels compared to controls. The eGFR calculated using MDRD equation was significantly reduced among diabetic patients (p<0.001). These findings indicate early renal impairment in T2DM.

## DISCUSSION

The present study demonstrates a statistically significant decline in eGFR among T2DM patients compared to non-diabetic controls. Similar findings were reported with previous studies as well that concluded progressive renal dysfunction in long-standing diabetes [6,7, 8]. In Previous studies it was also reported that serum creatinine as a standalone marker has its own limitations and emphasized the superiority of GFR estimation equations The rate of increase and the final concentration of serum creatinine depend on many factors including severity and time course of resolution of renal injury, rate of generation of creatinine, volume of distribution of creatinine and extra renal elimination [5,9]. Consequently, Levey et al. the MDRD equation was developed to improve accuracy in estimating renal function [5]. The findings our study Concorde the utility of MDRD equation in routine clinical practice for screening renal function patients The importance of routine GFR monitoring in the detection of early decline in renal function may precede overt proteinuria.[8].

The study of our findings supported by previous study that reported significantly lower eGFR values among T2DM patients compared to controls[6]. As per previous literature demonstrated that high prevalence of reduced eGFR among diabetic patients as Hyperglycemia-induced intraglomerular hypertension and metabolic stress accelerate nephron loss and Strict glycemic control, blood pressure management, and use of renin-angiotensin system blockers have been shown to delay progression of diabetic nephropathy [10]. Our study concluded that when diabetic patients were compared with non diabetic subjects, it was found that the diabetic group had increased blood glucose, serum creatinine and decreased eGFR levels. This difference was found to be statistically significant, indicating the derangement of kidney function. This indicate towards the burden of kidney disease in type 2 diabetes mellitus.

## CONCLUSIONS

The current study adds to this evidence by providing data from a tertiary care centre. eGFR should be estimated when patients are diagnosed as diabetics and at time of follow up annually. Early detection of renal damage may help to delay the process. Good control of blood glucose level is absolute requirement to prevent progressive renal impairment. This study will be very helpful to clinicians to begin necessary medical therapy. Strengths of the present study include use of standardized equation and well-matched control group. However, limitations of this study include small sample size and single-centre design. Longitudinal follow-up studies are required to evaluate progression.

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