Diagnostic Assessment of Cases with Chronic Kidney Disease with Diabetes Mellitus Type 2

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ABSTRACT

Introduction: The currently available data in the public domain, is either from some specific regions in the country or it doesn't capture the prevalence of CKD specifically in T2DM population.[9,14] Therefore, it was eminent to perform a pan-India epidemiological study to get a clear cut idea on the prevalence of CKD in T2DM patients. Hence, the present study was conducted to assess the clinical spectrum of CKD patients with type 2 diabetes mellitus.

Material and Methods: This was a cross-sectional, observational, study to assess the clinical spectrum of CKD among T2DM patients. The blood/plasma and urine samples, were collected for estimation of hemoglobin A1c, microalbuminuria, serum creatinine, urine creatinine, and routine urine analysis.

Results: When assessed blood pressures of the cases, we observed that the mean systolic blood pressure was 138 (12.4) mmHg, and mean diastolic blood pressure among the study subjects was 84 (6.4) mmHg. The mean HbA1C levels observed among the cases was 7.9 (1.27).

Conclusion: Study reported higher prevalence of CKD which was driven by the ACR levels and majority of the patients had reasonable eGFR. This can be a guide to select drug and dosage of diabetes drug as it depends on kidney function.

Keywords: Chronic Kidney Disease, Diabetes Mellitus Type 2

INTRODUCTION

Worldwide, diabetes mellitus (DM) has become an important public health problem, with its prevalence ranging from 6.9 to 10.2% in developed countries and almost over 7% in the developing countries.[1,2] As per the International Diabetes Federation Atlas (IDFA) for 2015, about 69 million people in India and over 415 million people across the globe are suffering from diabetes.[3] It is projected that the prevalence of diabetes will rise alarmingly, reaching up to 124 million in India, and over 640 million worldwide by 2040.[3] Over 70% of the population with diabetes lives in low and middle income countries. Despite this high prevalence and an important public health threat, Type 2 DM (T2DM) was not recognized and not included in the United Nations millennium development goals. This rise, in prevalence of diabetes increases disease related mortality and morbidity. It also significantly enhances the burden on health care infrastructure, care givers and society.[4] The mortality and morbidity due to DM is attributed to a range of complications, which includes both micro-vascular and macro-vascular complications. One such microvascular complication is diabetic nephropathy, which is characterized by microalbuminuria, which over long period turns into macro albuminuria, causing overt nephropathy.[5] The glomerular filtration rate (GFR) also deteriorates significantly in this process. If not treated, and addressed medically, nephropathy progresses into chronic kidney disease (CKD). CKD in patients who have T2DM, is clinically defined as, elevated urinary albumin excretion ≥ 30 mg/g, a persistent reduction in the estimated GFR (eGFR) of anti-diabetic drugs in T2DM patients who have CKD. CKD also significantly amplifies the risk of developing several complications if coupled with DM. These complications range from cardiovascular diseases, heart failure, renal failure, infections, adverse drug reactions to impaired quality of life and premature deaths.[10-13] Despite rising incidence of diabetes in India, we currently lack country wide robust, reliable data on the prevalence of CKD in T2DM patients. The currently available data in the public domain, is either from some specific regions in the country or it doesn't capture the prevalence of CKD specifically in T2DM population.[9,14] Therefore, it was eminent to perform a pan-India epidemiological study to get a clear cut idea on the prevalence of CKD in T2DM patients. Hence, the present study was conducted to assess the clinical spectrum of CKD patients with type 2 diabetes mellitus.

MATERIAL AND METHODS

It was a cross sectional study, conducted among the known cases of type 2 diabetes mellitus under the department of General Medicine in a tertiary healthcare institute in Maharashtra during June 2018 to November 2018 (6 months). All the baseline data was collected with the help of standard, semi-structured, pre-validated case record proforma. Clinical history was noted, general and systemic xamination findings were noted. Necessary investigations were carried out.

Source of Data: All the cases of diabetes mellitus (type 2), who were willing to participate in the study, after the approval from the institutional ethical committee, visiting

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to out-patients department or admitted under department of general medicine in a tertiary healthcare institute were included in the present study.

The data was entered using MS Excel software and analysed using SPSS version 22 software. The data was represented in the form of tables and charts for frequency distribution.

RESULTS

In the present study, which was conducted among the cases of type 2 diabetes mellitus, the mean age of the study participants was 48.6 (8.97) years. In the present study, majority of the cases were males 134 (53.6%), whereas females were 116 (46.4%) (Table 1).

We calculated the anthropometric indices of the study participants. We observed that the mean height of the cases was 163.2 (7.95) cm, whereas mean weight of the cases was 68.87 (15.57). The mean waist circumference of the study subjects was 96.6 (9.56) cm. The mean body mass index of the study cases was 26.7 (3.45).

When assessed blood pressures of the cases, we observed that the mean systolic blood pressure was 138 (12.4) mmHg, and mean diastolic blood pressure among the study subjects was 84 (6.4) mmHg. The mean HbA1C levels observed among the cases was 7.9 (1.27).

Baseline Characteristics	Mean (±SD)
Age (years)	48.6 (8.97)
Gender n (%)	
Female	116 (46.4%)
Male	134 (53.6%)
Anthropometry	
Height (cm)	163.2 (7.95)
Weight (Kg)	68.87 (15.57)
Waist circumference (cm)	96.6 (9.56)
BMI (Kg/m^2)	26.7 (3.45)
Blood pressure (mmHg) and others	
Systolic	138 (12.4)
Diastolic	84 (6.4)
HbA1c	7.9 (1.27)
Serum Creatinine/dL	1.37 (0.34)
Albumin (mg/L)	138 (367.8)

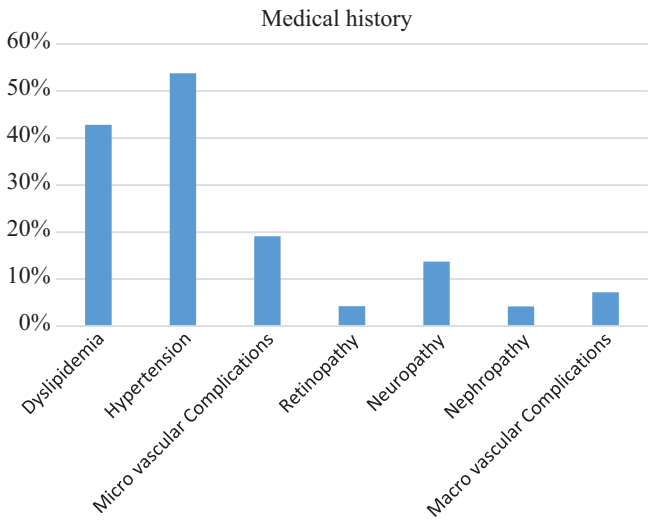
Table-1: Demographic features and investigation results

Duration of Type 2 Diabetes Mellitus	Number of cases	Percentage
0 years	2	0.8%
<5 years	68	27.2%
5 to 10 years	83	33.2%
>10 years	97	38.8%

Table-2: Duration of Type 2 Diabetes Mellitus

GFR categories in CKD	Number of cases	Percentage
G1 (Normal or High)	70	28%
G2 (Mildly decreased)	95	38%
G3a (Mild to moderately decreased)	42	16.8%
G3b (moderately to severely decreased)	20	8%
G4 (Severely decreased)	14	5.6%
G5 (Kidney Failure)	9	3.6%

Table-3: GFR categories in CKD



The systolic and diastolic blood pressure and hematological and general chemistry parameters like HbA1c, serum creatinine, albumin, creatinine and eGFR are listed in Table 1. Subjects reported both micro and macro vascular complications with neuropathy to be highest, nephropathy, and known coronary artery disease as mentioned in figure 1. The details of the duration of these co-morbid conditions are listed in (Table 2). In the studied population with T2DM, had mildly decreased (38%), 16.8% had mild to moderately decreased GFR. (Table 3)

DISCUSSION

The present study aimed at assessing the prevalence of CKD in T2DM subject's across the country. CKD in T2DM patients is characterized by a persistent elevated urinary albumin creatinine ratio (ACR) ≥ 30 mg/g, a persistent reduction in estimated glomerular filtration rate (eGFR) <60 ml/min/1.73 m^2, or both. Worldwide several large cross sectional studies have been carried out to assess the CKD prevalence and they have reported a prevalence of around 50% of patients with T2DM.[18] We proposed a combined use of eGFR and ACR for early detection of renal dysfunction as against serum creatinine, a common measurement for kidney function in routine practice, considering it to be a poor marker of kidney dysfunction.[19] We adopted MDRD equation to compute eGFR. Another, important marker for kidney impairment is albuminuria, Albumin Creatinine Ratio (ACR). Also, there are reports on the significant correlation between ACR and eGFR. With these changes in the study design and estimation parameters we attempted to get the best possible estimation of the CKD prevalence.

We reported a 34% prevalence of CKD (stage 3-5) In T2DM patients in across the population enrolled at several centers in India which is in line with the other reported numbers. A similar study from US with a sample size comparable to ours, presented a similar CKD prevalence of 43.5% (95%

confidence interval: 41.6-45.4).[20] In PERCEDIME2 study from Spain, the prevalence of CKD was estimated to be 27.9% in 1145 T2DM patients of >40 years of age.[21] Similarly in another study conducted in Thailand, prevalence of CKD stage 3-5 were 27.09 and 25.28%.[22] In another Spanish study, the prevalence of CKD in T2DM patients treated at primary care level was 34.6%.[23] Further, study done by Janmohamed et al. found CKD in 83.7 % of diabetics which is relatively higher than the prevalence reported elsewhere.[24] In Singapore, a study performed at a primary care cluster, consisting of multi-ethnic Asian population, prevalence of CKD in T2DM patients found to be 53%.[25]

Our study revealed that about 25% of the patients had microalbuminuria (stage A2), while macroalbuminuria (A3) was present in 2.0% patients. Microalbuminuria is a known indicator of renal dysfunction and also prognosticator of cardiovascular disease.[27] Thus, our results represented the proportion of T2DM patients in Indian population with different stages of CKD based on eGFR and albuminuria.

We investigated the duration of T2DM in patients with CKD. The proportion of T2DM patients with CKD were almost equal (approximately 30%) for different durations of T2DM since diagnosis (<5years, 5-10 years, and >10 years). A similar study from Bangladesh also found no significant correlation between duration of T2DM (< 5 years or 5-10 years) and renal function parameters (serum creatinine, ACR, eGFR,).[28] However, a Chinese study revealed significant association of CKD with duration of diabetes.[29]

An interesting observation from our study, we observed that possibility of CKD prevalence in T2DM patients is independent of duration of diabetes post diagnosis. Hence, it is recommended to screen for CKD in T2DM patients, soon after diagnosis of diabetes because usually there is delay in diagnosis after onset of T2DM.[30]

We analysed HbA1c goal attainment of <7% in T2DM patients with/ without CKD. The result of our study suggested that lesser proportion of patients with CKD (23.4%) had achieved the target HbA1c level as compared to those without CKD (30%). Onset of CKD can be prevented/ delayed at early stages by optimal glycaemic control.[30] As per KDOQI clinical practice guidelines, diabetic patients should have target of <7.0% for HbA1C regardless of the presence or absence of CKD.[31] But, target of 7% to 8% is acceptable for patients with severe comorbidities like CKD.[32] A recent study from Italy reported, despite using anti-diabetic drugs in T2DM patients, CKD was associated with failure in achievement of recommended target for HbA1C.[33]

In order to improve the glycaemic control of T2DM patient with renal complication, there is a need to identify the factors linked with glycaemic control.[34] Our result also indicated that poor control of HbA1c is an indicator of renal insufficiency and that there is need for investigating concomitant renal disease in patients with T2DM. Haque N et al, found correlation of HbA1c with serum creatinine and ACR and concluded that in monitoring diabetes mellitus, poor control of HbA1c is suggestive of need for renal function tests.[28] We support this approach as our findings reflect that less proportion of T2DM patients with CKD achieved HbA1C goal.

CONCLUSIONS

Our study reported a high prevalence of CKD in T2DM patients in India. This high prevalence was driven by high proteinuria but reasonable GFR. This insights will be a good guide to select diabetes drug as choice of many class of drugs depends on kidney function.

REFERENCES

1. IDF Diabetes Atlas Sixth Edition Update. International Diabetes Federation. IDF Diabetes Atlas 2014;2: 15-19.
2. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. Diabetes research and clinical practice 2010;87: 4-14.
3. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. Diabetes research and clinical practice 2011;94: 311-321.
4. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. The Australasian Medical Journal 2014;7: 45-8.
5. Caramori ML, Fioretto P, Mauer M. The need for early predictors of diabetic nephropathy risk: is albumin excretion rate sufficient? Diabetes 2000;49: 1399-408.
6. Thomas MC, Weekes AJ, Broadley OJ, Cooper ME, Mathew TH. The burden of chronic kidney disease in Australian patients with type 2 diabetes (the NEFRON study). Med J Aust 2006;185: 140-144.
7. Dwyer JP, Parving HH, Hunsicker LG, Ravid M, Remuzzi G, et al. Renal dysfunction in the presence of normoalbuminuria in type 2 diabetes: results from the DEMAND study. Cardiorenal Med 2012;2:1-10.
8. Parving HH, Lewis JB, Ravid M, Remuzzi G, Hunsicker LG, et al. Prevalence and risk factors for microalbuminuria in a referred cohort of type II diabetic patients: a global perspective. Kidney Int 2006;69: 2057-2063.
9. Scott D. Treatment of type 2 diabetes in chronic kidney disease: a case for linagliptin in the treatment of diabetes in severe renal impairment. Diabetes, metabolic syndrome and obesity: targets and therapy 2013;6: 359-363.
10. Ekundayo OJ. Multimorbidity due to diabetes mellitus and chronic kidney disease and outcomes in chronic heart failure. Am J Cardiol 2009;103: 88-92.
11. So WY, Kong AP, Ma RC, Ozaki R, Szeto CC, et al. Glomerular filtration rate, cardiorenal end points, and all-cause mortality in type 2 diabetic patients. Diabetes Care 2006;29: 2046-2052.
12. McCullough PA, Li S, Jurkovitz CT, Stevens L, Collins AJ, et al. Chronic kidney disease, prevalence of premature cardiovascular disease, and relationship to short-term mortality. Am Heart J 2008;156:277-283.
13. Thomas MC, Brownlee M, Susztak K, Sharma K, Jandeleit-Dahm KA, et al. Diabetic kidney disease. Nat Rev Dis. Primers 2015;1:15018.
14. Papademetriou V, Lovato L, Doumas M, Nylen E, Mottl A, et al. Chronic kidney disease and intensive glycemic control increase cardiovascular risk in patients with

type 2 diabetes. Kidney international 2015;87: 649-659.
15. Prasannakumar M, Rajput R, Seshadri K, Talwalkar P, Agarwal P, et al. An observational, cross-sectional study to assess the prevalence of chronic kidney disease in type 2 diabetes patients in India (START -India). Indian J Endocr Metab 2015;19: 520-523.
16. Inker LA, Astor BC, Fox CH, Isakova T, Lash JP, et al. KDOQI US commentary on the 2012 KDIGO clinical practice guideline for the evaluation and management of CKD. American journal of kidney diseases: the official journal of the National Kidney Foundation 2014;63: 713-735.
17. Singh AK, Farag YM, Mittal BV, Subramanian KK, Reddy SR, et al. Epidemiology and risk factors of chronic kidney disease in India - results from the SEEK (Screening and Early Evaluation of Kidney Disease) study. BMC nephrology 2013;14: 114.
18. Thomas MC, Cooper ME, Zimmet P. Changing epidemiology of type 2 diabetes mellitus and associated chronic kidney disease. Nat Rev Nephrol 2016;12: 73-81.
19. McFarlane P, Gilbert RE, MacCallum L, Senior P. Chronic kidney disease in diabetes. Canadian journal of diabetes 2013;37: S129-S36.
20. Bailey RA, Wang Y, Zhu V, Rupnow MF. Chronic kidney disease in US adults with type 2 diabetes: an updated national estimate of prevalence based on Kidney Disease: Improving Global Outcomes (KDIGO) staging. BMC research notes 2014;7: 415.
21. Rodriguez-Poncelas A, Garre-Olmo J, Franch-Nadal J, Diez-Espino J, MundetTuduri X, et al. Prevalence of chronic kidney disease in patients with type 2 diabetes in Spain: PERCEDIME2 study. BMC Nephrology 2013;14: 46.
22. Narenpitak S, Narenpitak A. Prevalence of chronic kidney disease in type 2 diabetes in primary health care unit of Udon Thani province. Thailand J Med Assoc Thaiv 2008;91: 1505-1513.
23. Lou Arnal LM, Campos Gutierrez B, Cuberes Izquierdo M, Gracia Garcia O, Turon Alcaine JM, et al. Prevalence of chronic kidney disease in patients with type 2 diabetes mellitus treated in primary care. Nefrologia: publicacion oficial de la Sociedad Espanola Nefrologia 2010;30: 552-556.
24. Janmohamed MN, Kalluvya SE, Mueller A, Kabangila R, Smart LR, et al. Prevalence of chronic kidney disease in diabetic adult out-patients in Tanzania. BMC Nephrol 2013;14: 183.
25. Low SK, Sum CF, Yeoh LY, Tavintharan S, Ng XW, et al. Prevalence of chronic kidney disease in adults with type 2 diabetes mellitus. Ann Acad Med Singapore 2015;44: 164-171.
26. Rajapurkar MM, John GT, Kirpalani AL, Abraham G, Agarwal SK, et al. What do we know about chronic kidney disease in India: first report of the Indian CKD registry. BMC nephrology 2012;13: 10.
27. Zoja C, Zanchi C, Benigni A. Key pathways in renal disease progression of experimental diabetes. Nephrol Dial Transplant 2015;30: iv54-iv9.
28. Haque N, Debnath BC, Ibrahim M, Sirajuddin K, Majumder M, et al. Association of HbA1c with Urinary ACR & eGFR in Type-2 Diabetes Mellitus. Pulse 2014;5: 6-11.
29. Lu B, Song X, Dong X, Yang Y, Zhang Z, et al. High prevalence of chronic kidney disease in population-based patients diagnosed with type 2 diabetes in downtown Shanghai. J Diabetes Complications 2008;22: 96-103.
30. Gross JL, de Azevedo MJ, Silveiro SP, Canani LH, Caramori ML, et al. Diabetic Nephropathy: Diagnosis, Prevention, and Treatment. Diabetes care. 2005;28: 164-176.
31. Kashab S. KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Diabetes and Chronic Kidney Disease. Am J Kidney Dis 2007;49: S12-154.
32. Ioannidis I. Diabetes treatment in patients with renal disease: Is the landscape clear enough? World J Diabetes 2014;5: 651-658.
33. De Cosmo S, Viazzi F, Pacilli A, Giorda C, Ceriello A, et al. Achievement of therapeutic targets in patients with diabetes and chronic kidney disease: insights from the Associazione Medici Diabetologi Annals initiative. Nephrology, dialysis, transplantation: official publication of the European Dialysis and Transplant Association - European Renal Association 2015;30: 1526-1533.
34. Huri HZ, Lim LP, Lim SK. Glycemic control and antidiabetic drugs in type 2 diabetes mellitus patients with renal complications. Drug design, development and therapy 2015;9: 4355-4371.

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