



An observational study on the prevalence and complications of chronic kidney disease in patients with diabetes mellitus

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Abstract

Background. Chronic kidney disease (CKD) is a significant complication in patients with diabetes mellitus (DM), contributing to increased morbidity and mortality. The purpose of the study was to analyse the prevalence and complications of chronic kidney disease in patients with Type II diabetes mellitus in tertiary hospital.

Methods. A prospective observational study was conducted in a tertiary care hospital over six months (January – June 2024). One hundred adult patients with T2DM and CKD, defined according to KDIGO 2012 guidelines, were included. Demographic, clinical, and biochemical data were collected, including serum creatinine, blood urea, and albuminuria. Descriptive and comparative statistical analyses were performed.

Results. Among the study population, 58% were male and 42% female, with the majority aged 60–69 years (34%). Elevated serum creatinine (74%) and blood urea (68%) were observed, indicating significant renal impairment. Macroalbuminuria (MAA) was the predominant category of albuminuria, particularly in older patients and non-smokers. The most frequent comorbidities included hyperlipidaemia (84%), anaemia (71%), vision impairment (58%), hypertension (48%), thyroid disorders (44%), acid peptic disease (38%), and urinary tract infections (34%). Lifestyle factors such as smoking and alcohol consumption were significantly correlated with albuminuria categories.

Conclusion. The study highlights a high prevalence of CKD and its complications among patients with T2DM, particularly in older males. Regular monitoring of renal function and early detection of albuminuria are critical for preventing progression. Targeted interventions addressing comorbidities and lifestyle factors may improve long-term outcomes in this high-risk population.

Keywords: chronic kidney disease, type 2 diabetes mellitus, macroalbuminuria, serum creatinine, blood urea, complications.

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Наблюдательное исследование частоты и осложнений хронической почечной недостаточности у пациентов с сахарным диабетом

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Аннотация

Введение. Хроническая почечная недостаточность (ХПН) – это серьезное осложнение, развивающееся у пациентов с сахарным диабетом (СД), которое способствует повышению заболеваемости и смертности. Целью исследования было проанализировать частоту и осложнения ХПН у пациентов с СД 2-го типа в специализированной больнице.

Методы. Проспективное наблюдательное исследование проводили на базе специализированной больницы в течение 6 мес (с января по июнь 2024 г.). В исследование включили 100 взрослых пациентов с СД 2-го типа и ХПН, диагностированной в соответствии с рекомендациями KDIGO 2012. Выполнен сбор демографических, клинических и биохимических данных, включая уровень креатинина в сыворотке крови, уровень мочевины в крови, тяжесть альбуминурии.

Результаты. В исследованной популяции 58% были мужчинами, 42% – женщинами, при этом возраст большинства составил 60–69 лет (34%). Выявлен повышенный уровень креатинина в сыворотке (74%) и мочевины в крови (68%), что говорит о значительном нарушении функции почек. Макроальбуминурия (МАО) была наиболее часто встречающейся формой альбуминурии, особенно у пожилых пациентов и некурящих людей. Наиболее частыми сопутствующими заболеваниями были гиперлипидемия (84%), анемия (71%), нарушения зрения (58%), артериальная гипертензия (48%), заболевания щитовидной железы (44%), гиперпродукция соляной кислоты и пепсина (38%), инфекции мочевыводящих путей (34%). Факторы образа жизни, такие как курение и употребление алкоголя, значимо коррелировали с тяжестью альбуминурии.

Выводы. Исследование демонстрирует высокую распространенность ХПН и ее осложнений среди пациентов с СД 2-го типа, особенно среди пожилых мужчин. Регулярный мониторинг функции почек и раннее выявление альбуминурии имеют решающее значение для

предотвращения прогрессирования заболевания. Вмешательства, направленные на коррекцию сопутствующих заболеваний и факторов образа жизни, могут улучшить долгосрочные результаты в этой группе высокого риска.

Ключевые слова: хроническая почечная недостаточность, сахарный диабет 2-го типа, макроальбуминурия, креатинин сыворотки крови, мочевины крови, осложнения.

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Introduction

Chronic kidney disease (CKD) and kidney failure are most frequently caused by Diabetes mellitus (DM), an epidemic that is on the rise. Diabetic nephropathy is one of the most prevalent complications associated with diabetes, affecting between 20–40% of people with the disease. The main cause of CKD is diabetes because high blood sugar can harm kidney blood vessel making it more difficult for the kidney to filter waste and extra fluid from the body [1]. DM and CKD have a complicated and reciprocal interaction. Numerous processes, such as oxidative stress, inflammation, and fibrosis brought on by hyperglycaemia, can result in CKD in people with diabetes mellitus [2, 3]. However, by decreasing insulin sensitivity, increasing glucose reabsorption, and encouraging the development of insulin resistance, CKD can worsen DM [4]. Research has repeatedly demonstrated that between 20% and 50% of patients with DM develop CKD. However, the demographic, diagnostic standards, and study design all have a significant impact on the frequency and consequences of CKD in DM patients. Furthermore, CKD is frequently underdiagnosed and undertreated in DM patients, which results in poor health outcomes and higher medical expenses. In addition to ensuring appropriate glycemic control, screening for diabetic nephropathy and early treatments are essential for slowing its progression. Over 10–15% of world population has recognized CKD as a global health issue. Approximately around 422 million adults in the world population are living with DM, 40% of them develop CKD. Diabetic patients with CKD substantially increase the risk of early death and cardiovascular morbidity and mortality.

DM and CKD coexist because they have similar causes, such as aging, vascular inflammation, hypertension, and dyslipidaemia. It is now widely acknowledged that strict glycemic control lowers the risk of retinopathy, neuropathy, and nephropathy in individuals with both type 1 and type 2 diabetes, based on extensive intervention trials. Notably, the probability of negative renal outcomes, such as incident microalbuminuria and progression to macroalbuminuria, is reduced by appropriate glucose control. Trials supporting strict glycemic control as a risk-reduction strategy for individuals with incident cardiovascular disease are scarce, despite the fact that hyperglycaemia is also substantially linked to macrovascular disease in observational trials [5].

The standard measure for renal function and its diagnosis and management is glomerular filtration rate (GFR). According to GFR, the 2012 KDIGO CKD classification divides CKD into 6 groups which includes: G1: GFR 90 mL/min per 1.73 m² and above, G2: GFR 60 to 89 mL/min per 1.73 m², G3a: GFR 45 to 59 mL/min per 1.73 m², G3b: GFR 30 to 44 mL/min per 1.73 m², G4: GFR 15 to 29 mL/min per 1.73 m² and G5: GFR less than 15 mL/min per 1.73 m² or treatment by dialysis [6].

CKD affects more than 10% of the global population over 800 million people and are more common in older adult's

women, racial minorities and those with diabetes or hypertension. It also adds a lot of financial and resource burden on healthcare of any nation [7]. Several CKD registries such as USRDS, provides estimates of the incidence and prevalence of this illness in various countries. Worldwide, DM is the leading cause of CKD an end stage kidney disease accounting for 50% of cases [8].

Progressive CKD is associated with the number of consequences that are more common and severe. These results in increased morbidity and poor quality of life. Hypertension is one of the most harmful complications of CKD and it contributes to the progressive decline in kidney function, cardiovascular disease and related mortality [9]. The risk of cardiovascular events increases with CKD this include non – atherosclerotic pathologies, left ventricular hypertrophy with diastolic and systolic dysfunction, valvular disease and arterial classification. Anaemia is a common complication along with CKD and it can affect the quality of life. It also contributes to the mortality and morbidity of CKD progression rate. CKD patients tend to have inflammatory state; this persistent inflammation can contribute in the variability of HB levels. Iron deficiency anaemia is the most common type of anaemia found in CKD patients. These patients can suffer from both absolute and functional iron deficiency [10]. The association between anaemia and mortality may be related to severity of anaemia. Retinopathy and CKD are typically considered microvascular complications of diabetes. Longer duration of diabetes is one of the main factors along with decreased GFR and more proteinuria contributes to this [11]. Hyperlipidaemia is one of the most prevalent risk factors of CKD, suggesting that lipid accumulation in the renal parenchyma is detrimental to renal function [12]. Mostly CKD patients are at the risk of urinary tract infection, arthritis, acid peptic disease and thyroid disease. There is a lack of regional data on CKD prevalence and complication profiles among diabetic patients in tertiary care hospitals. This study addresses that gap by analysing demographic, biochemical, and lifestyle factors in relation to CKD severity. Therefore, this study was undertaken to assess the prevalence of CKD and its associated complications in patients with T2DM attending a tertiary care hospital. By identifying demographic, clinical, and biochemical correlates, the findings aim to provide insights that could support early intervention strategies and improve patient outcomes. By identifying the associated risk factors and complications, this study seeks to provide insights for developing targeted interventions to mitigate the impact of CKD in diabetic populations.

Materials and methods

A prospective observational study was conducted for 6 months in a tertiary hospital involved 100 patients of both genders having CKD with type 2 DM. The participants were adults (18–80y) with T2DM&CKD (as per KDIGO 2012 classification: GFR <90 mL/min/1.73m² with evidence of kidney damage) were included. Patients with non-diabetic

CKD, pregnancy, incomplete records or kidney transplantation in the previous year were excluded. The study aimed to assess the prevalence of CKD, its associated complications, and the role of various clinical, biochemical, and demographic factors. The proposal of the study was submitted to the institutional review board and received approval (VMKVMC&H/IEC/24/085). Informed consent was obtained from all the patients by the investigators before the patients were involved in the study. The sample size was selected by using non-random purposive sampling technique. A total of 100 patients were selected based on inclusion and exclusion criteria which were regarded as sample size for the study. Data were collected on demographics, clinical characteristics, lifestyle factors, and laboratory parameters, including blood urea, serum creatinine, and albuminuria levels.

Patient inclusion exclusion criteria

Patients who agreed to engage in the study. Patients who have CKD with type 2 DM, who can be both newly discovered or already known case with different socio-economic backgrounds. All the patients were above 18 years and under the age of 80 years. Patients with CKD caused by condition other than diabetes were excluded. Pregnant women and patients with incomplete medical records were excluded. Patients who undergone kidney transplantation within the last year were also excluded.

Data collection

The data collected were the age, gender, BMI, family history of CKD with DM along with smoking status. The data regarding the serum urea, creatinine were used to find the GFR rate. The albuminuria was categorized as microalbuminuria (MA), macroalbuminuria (MAA) and normoalbuminuria (NA) to compare with GFR. The study also listed the complications along with CKD with type 2 DM. Procedures included the collection of cases recording the details from lab reports to the PROFORMA. The glomerular filtration rate along with other complications were monitored. Data were analysed using appropriate statistical methods. Descriptive statistics were used to summarize demographic and clinical characteristics, while comparative analysis was performed to identify correlations between risk factors and disease severity.

Results

A cross-sectional observational study was conducted among 100 diabetic patients with chronic kidney disease (CKD) at VMKVMC&H, Salem, Tamil Nadu, to investigate the prevalence and complications of CKD in diabetic individuals.

1. Demographic and Clinical Characteristics. The sociodemographic details of the study population was presented in Table 1. It clarifies that out of 100 patients with T2DM and CKD, 58% were male and 42% female, indicating a higher prevalence among males. The largest proportion of patients were in the 60–69 years age group (34%), followed by 50–59 years (28%) and 40–49 years (19%), showing that CKD prevalence increased with age.

Regarding occupation, 58% were unemployed, and 42% employed, reflecting possible socioeconomic influence on disease distribution. In terms of nutritional status, 39% had a normal BMI, while 24% were overweight and 24% obese,

Table 1. Prevalence of CKD in patients with DM

Variables	Subgroups	Total no of patients	Percentage of patients, %
Gender	Male	58	58
	Female	42	42
Age group, years	18–29	2	2
	30–39	5	5
	40–49	19	19
	50–59	28	28
	60–69	34	34
	>70	1	1
Occupation	Employed	42	42
	Unemployed	58	58
Body mass index	Underweight<18.5	8	8
	Normal 18.5–24.9	39	39
	Overweight 25–29.9	24	24
	Obese 30–34.9	24	24
	Extremely obese >35	5	5

suggesting that nearly half of the patients were above normal weight. A smaller proportion were underweight (8%) or extremely obese (5%).

2. Clinical profile and complications of the study participants. The distribution of variables such as blood pressure, glycemic control, renal parameters, and associated complications was evaluated and presented in Table 2, which highlights the overall burden of metabolic and renal abnormalities as well as the prevalence of comorbid conditions in patients with T2DM and CKD.

Table 2 elucidates that, among the patients in the study, 4% had systolic blood pressure readings below 120 mmHg, 70% had readings between 120 and 159 mmHg, and 26% had readings above 160 mmHg. Just 24% of diastolic blood pressure readings were below 90 mmHg, whereas the majority (68%) were between 90 and 99 mmHg.

According to glycaemic evaluation, 78% of patients had increased FBS and 83% of patients had high or very high PPBS, whereas only ≤2% of patients had excellent control. Abnormal renal parameters were also common; 68% of patients had increased urea, and 74% had raised creatinine. The most common consequences were hypertension (65%), anaemia (71%), hyperlipidaemia (84%), and visual issues (58%). Urinary tract infections (34%), acid peptic illness (38%), and thyroid disorders (44%), were among the other prevalent ailments. Arthritis (8%), sleep disturbances (2%), and kidney and coronary artery disease (18% each) were fewer common findings. No psychiatric conditions were mentioned.

3. Correlation of Albuminuria with Renal Function. On examining the relationship between albuminuria and eGFR, the Figure provides important insights into the pathophysiological link between structural kidney injury and functional impairment, thereby aiding in risk stratification and early intervention strategies.

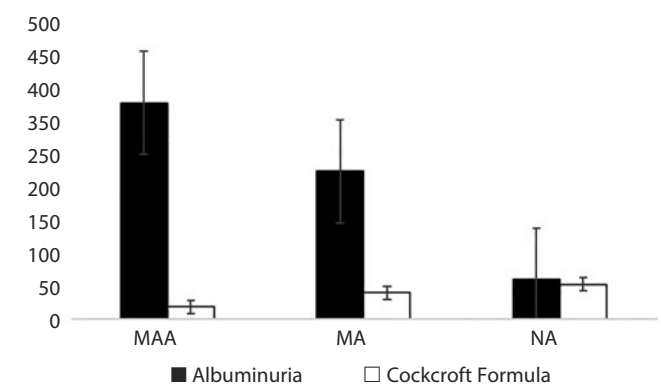
The relationship between albuminuria levels – categorized as macroalbuminuria (MAA), microalbuminuria (MA), and normal albuminuria (NA) – and estimated glomerular filtration rate (eGFR) calculated using the Cockcroft-Gault formula. Albuminuria values were highest in the MAA group, with significant variability, while eGFR values were consistently lower and demonstrated less intergroup variation.

Table 2. Distribution of Clinical Parameters and Associated Complications among the Study Population			
Variables	Parameters	No of patients	% of patients
Systolic Blood Pressure	<120 mmHg	4	4
	120–139 mmHg	36	36
	140–159 mmHg	34	34
	>160 mmHg	26	26
Diastolic Blood Pressure	<80 mmHg	8	8
	80–89 mmHg	16	16
	90–99 mmHg	68	68
	>100 mmHg	8	8
PPBS	Optimal	2	2
	Fair	15	15
	High	52	52
	Very high	31	31
FBS	Optimal	1	1
	Fair	21	21
	High	49	49
	Very high	29	29
Urea	Low	2	2
	Optimal	30	30
	High	68	68
Creatinine	Low	3	3
	Optimal	22	22
	High	74	74
Complications	Hypertension	65	65
	Hyperlipidemia	84	84
	UTI	34	34
	CAD	18	18
	Sleep disorders	2	2
	Arthritis	8	8
	Acid peptic disease	38	38
	Thyroid disorders	44	44
	Kidney disease	18	18
	Vision problems	58	58
	Anaemia	71	71
	Psychiatric disorders	0	0
	Others	48	48

4. Clinical Features and Albuminuria Categories. Comparative evaluation of patients with macroalbuminuria (MAA), microalbuminuria (MA), and normal albuminuria (NA) were demonstrated in Table 3 which provides insights into how age distribution, anthropometric parameters, smoking status, and alcohol consumption are associated with renal impairment.

Table 3 presents the clinical characteristics associated with varying degrees of albuminuria. Patients with MAA and MA were significantly older compared to those with NA ($p<0.05$). The mean body weight was highest in the NA group (91.6 ± 5.3 kg), whereas patients with MA and MAA had lower mean weights (~ 71 kg). Interestingly, smoking and alcohol consumption were more common in the NA group, while most MAA patients were non-smokers and non-alcoholic, suggesting complex associations between lifestyle and disease severity.

Correlation between glomerular filtration rate and albuminuria



Discussion

Our study demonstrates a high prevalence of CKD among patients with T2DM, with older age, male gender, and poor glycemic control emerging as major contributors. These findings align with prior Indian studies and reinforce the well-recognized role of diabetes as a leading cause of CKD worldwide. However, the complication profile observed in our cohort, particularly the high rates of hyperlipidaemia and anaemia, suggests a unique pattern that warrants targeted interventions

Nearly three-quarters of participants exhibited elevated serum creatinine and macroalbuminuria predominated, indicating advanced renal involvement these findings reinforce the well-established role of T2DM as the leading cause of CKD worldwide, accounting for almost 40–50% of ESRD cases. The higher prevalence in males aligns with findings from Bao et al. [13], who reported a gender-related predisposition. Similarly, the predominance of cases in the 60 to 69-year age group is consistent with prior research by Pietro Raven et al. [14], which emphasized age as a critical risk factor.

BMI distribution revealed that patients with normal weight had higher CKD prevalence than overweight or obese groups. While obesity is a well-known risk factor for CKD, this finding suggests that BMI alone may not adequately predict CKD risk in diabetic individuals, pointing to the need for further metabolic profiling.

Family history, smoking, and alcohol use were common in the population. These factors were significantly associated with increased albuminuria and disease progression, as supported by Jan Jeske et al. [15]. Their strong correlation underlines the importance of lifestyle interventions and early education to mitigate risk.

Hypertension, especially systolic readings >140 mmHg and diastolic >90 mmHg, remains a primary driver of diabetic nephropathy. Strict control of glycemic indices, including RBS, FBS, and PPBS, is essential, as glycemic fluctuations contribute to both microvascular and macrovascular damage [16].

Renal function markers such as elevated urea and creatinine levels were present in over two-thirds of patients, reinforcing their value as accessible and sensitive indicators of renal impairment in diabetes.

The complication profile revealed a high incidence of hyperlipidaemia, anaemia, and visual impairment, emphasizing the need for a multidisciplinary approach in diabetes

Table 3. Clinical features of patients in relation to the rate of albuminuria

Parameter	MAA	MAA vs MA	MA	MA vs NA	NA	MAA vs NA
Age, years	58.19±13.41	NS	56.71±7.94	<0.01	48.10±8.92	<0.03
Weight, kg	70.98±12.40	NS	71.03±15.07	<0.01	91.60±5.34	<0.01
Smoking Habit (NS/S)	43/16		12/19		1/9	
Alcohol Consumption (NA/A)	40/19		15/16		0/10	
NS – Non-smokers, S – Smokers, NA – Non-Alcoholic, A – Alcoholic						

care. The high rate of anaemia is particularly concerning, as it can both result from and exacerbate CKD.

The correlation between albuminuria severity and age, weight, smoking, and alcohol habits suggests that while traditional risk factors contribute significantly, their interplay may be more complex in CKD pathogenesis. Interestingly, the NA group had more smokers and alcohol users, suggesting a need for longitudinal studies to better understand temporal relationships and causality.

Comparison with earlier Indian studies suggests that the prevalence of CKD among people with T2DM is gradually increasing, likely reflecting improved life expectancy, dietary transition, and suboptimal awareness of kidney health.

Conclusion

This study provides valuable insights into the prevalence, risk factors, and complications of chronic kidney disease (CKD) among diabetic patients. The findings underscore the significant burden of CKD in this population, particularly among older adults and males, with notable contributions from lifestyle factors, comorbid conditions, and poor glycemic control. Elevated blood urea and serum creatinine levels were prevalent in most patients, reflecting advanced

renal impairment. Albuminuria, a critical diagnostic indicator, showed a higher prevalence of macroalbuminuria (MAA) among older, non-smoking, and non-alcoholic patients. This highlights the need for targeted interventions based on patient-specific risk profiles. This study revealed high prevalence of CKD among patients with Type II DM and increased risk of complications such as Hyperlipidaemia, cardiovascular disease and Anaemia. The findings highlight the importance of early screening and management of CKD in patients with DM to prevent or delay the progression of kidney disease and related complications. Regular monitoring of kidney function and implementation of targeted interventions can improve health outcomes and quality of life for this high-risk patient population. Awareness programs and cost-effective screening strategies should be implemented at community and primary care levels. Larger, multicentre, and longitudinal studies are required to confirm these findings and explore genetic or regional variations.

Conflict of interests. The authors declare that there is not conflict of interests.

Конфликт интересов. Авторы заявляют об отсутствии конфликта интересов

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