Research Article

Clinical and Biochemical Profile of Chronic Kidney Disease Patients on Dialysis in South Gujarat: A Cross-Sectional Study

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A B S T R A C T

Background: Chronic kidney disease (CKD) is a major public health concern in India, often presenting late with multiple complications. Understanding the demographic, clinical, and biochemical profile of patients on dialysis can help optimize management and improve outcomes.

Objectives: To evaluate the demographic distribution, clinical manifestations, biochemical parameters, and complications among CKD patients undergoing dialysis at a tertiary care hospital in South Gujarat.

Methods: This was a cross-sectional observational study conducted over 12 months (March 2020–March 2021) among 50 adult CKD patients on maintenance dialysis. Demographic details, clinical history, lifestyle factors, physical examination, and biochemical investigations (renal function, hematological profile, mineral metabolism, endocrine parameters, and vitamin status) were recorded. Data were analyzed using descriptive statistics.

Results: The mean age of patients was 44 ± 12.29 years, with male predominance (68%). Diabetic nephropathy (40%) and hypertensive nephropathy (32%) were the leading causes. Gastrointestinal symptoms (80%), pedal edema (52%), and neurological complaints (26%) were common. Hypertension (66%) and diabetes (48%) were the major comorbidities. Lifestyle risk factors included smoking (64%), tobacco chewing (28%), and alcohol intake (8%). Most patients (76%) presented in Stage 5 CKD. Anemia was highly prevalent (96%) with mean hemoglobin 7.5 ± 1.56 g/dl. Biochemical abnormalities included hyperphosphatemia (64%), hypocalcemia (88%), hyperparathyroidism (78%), Vitamin D deficiency (94%), and Vitamin B12 deficiency (50%). Low T3 syndrome was observed in 42% of cases. Cardiovascular complications were frequent (58%), particularly left ventricular hypertrophy (42%). Serum amylase abnormalities were detected in 62% of patients.

Conclusion: CKD patients in South Gujarat predominantly present at advanced stages with high prevalence of anemia, mineral bone disorders, thyroid dysfunction, vitamin deficiencies, and cardiovascular complications. Lifestyle factors such as smoking and alcohol consumption further worsen disease progression. Early detection, aggressive management of diabetes and hypertension, lifestyle modification, and multidisciplinary care are essential to reduce morbidity and improve survival in this population.

Keywords: *Chronic Kidney Disease, Dialysis, Biochemical Profile, Anemia, Mineral Bone Disorder, South Gujarat*

INTRODUCTION

Chronic Kidney Disease (CKD) is a major global health concern, characterized by structural or functional abnormalities of the kidneys that progressively lead to irreversible loss of function. In its advanced stages, CKD culminates in end-stage renal disease (ESRD), a life-threatening condition requiring renal replacement therapy (RRT) such as dialysis or kidney transplantation (1,2). The global burden of CKD has been rising steadily, with both prevalence and mortality showing a significant upward trend in recent decades (3,4).

In the early phases, CKD is often silent, with symptoms becoming evident only when renal function declines substantially. By the time patients develop complications, immediate interventions like dialysis or transplantation are often necessary. The disease is influenced by a wide range of risk factors, including diabetes, hypertension, genetic predisposition, socioeconomic conditions, and lifestyle-related exposures. Among these, diabetes and hypertension remain the most significant contributors to CKD worldwide (5–10).

Early identification of CKD plays a pivotal role in delaying progression to kidney failure. Regular screening in high-risk populations—such as individuals with diabetes, hypertension, advanced age, or a family history of kidney disease—can reduce late detection and improve outcomes (6,7). Unfortunately, many patients are diagnosed at advanced stages, which leads to delayed initiation of RRT and poorer survival rates (11).

In India, the reported prevalence of CKD varies widely, ranging from less than 1% to nearly 17%, reflecting regional and methodological differences in detection (12–14). The high cost of dialysis and limited access to transplantation make CKD an enormous health and economic burden in the country (11,15). In resource-constrained settings, patients often face significant challenges in accessing timely and adequate care.

Understanding the clinical and biochemical profile of CKD patients on dialysis is therefore crucial. Such data not only provide insights into disease patterns and complications but also help guide patient management and public health strategies. With this background, the present study was undertaken to evaluate the clinical and biochemical characteristics of patients with CKD undergoing dialysis at a tertiary care hospital in South Gujarat.

Methodology
Study Design and Setting
This was a cross-sectional observational study conducted at a tertiary care hospital in South Gujarat. The study was carried out over 12 months, from March 2020 to March 2021, following ethical approval.

Study Population
The study included patients diagnosed with chronic kidney disease (CKD) undergoing maintenance dialysis at the tertiary care center. Diagnosis was made according to Kidney Disease: Improving Global Outcomes (KDIGO) criteria.

Inclusion Criteria
- Patients aged ≥18 years
- Patients diagnosed with CKD on maintenance dialysis
- Patients willing to provide informed consent

Exclusion Criteria
- Patients aged <18 years
- Patients who had undergone renal transplantation
- Patients not willing to participate

Sample Size and Sampling Technique
All eligible patients who met the inclusion criteria and provided informed consent during the study period were included. The final study sample comprised **50 patients**.

Data Collection
Baseline demographic and clinical details, including age, sex, medical history, risk factors, family history, and physical examination findings, were recorded. Anthropometric measurements such as standing height, weight, mid-upper arm circumference (MUAC), and waist-to-hip ratio were taken. Quality of life was assessed using a global quality of life scale. Radiological investigations included renal length measurement, chest X-ray, and ultrasonography.

Laboratory Investigations
Blood investigations included complete blood count (CBC), renal function test (RFT), liver function test (LFT), calcium, phosphate, uric acid, thyroid profile, coagulation profile, vitamin B12, vitamin D3, amylase, ferritin, parathyroid hormone (PTH), magnesium, glycated hemoglobin (HbA1c), and arterial blood gas (ABG). Serological tests for HIV, HBsAg, and HCV were performed. ECG was also recorded.

Specimen Collection:
- **Blood:** Venous blood samples were collected in appropriate vacutainers (EDTA, citrate, fluoride, and plain) and sent for analysis.
- **Urine:** Sterile urine samples were collected, centrifuged, and tested for routine and microscopic examination.

Statistical Analysis

Data were entered into Microsoft Excel spreadsheets. Descriptive statistics were applied, and results were expressed as frequencies and percentages for categorical variables, and mean ± standard deviation (SD) for continuous variables.

RESULTS

This cross-sectional study included 50 patients with chronic kidney disease (CKD) undergoing dialysis at a tertiary care hospital in South Gujarat. The results describe the demographic characteristics, clinical presentation, biochemical profile, and complications observed in this population.

Demographics and Clinical Characteristics

The mean age of the study cohort was **44 ± 12.29 years**, with most patients (26; 52%) belonging to the 31–50 years age group. Males (34; 68%) outnumbered females (16; 32%). A prolonged disease history was common: 21 patients (42%) had CKD for 3–5 years, and 16 patients (32%) for more than 5 years.

Diabetic nephropathy was the leading cause of CKD, accounting for 20 cases (40%), followed by hypertensive nephropathy in 16 cases (32%). Etiology remained unknown in 5 cases (10%). Regarding habits, smoking was reported in 32 patients (64%), tobacco use in 14 (28%), and alcohol in 4 (8%).

Table 1. Clinical Characteristics of Patients (n = 50)

Characteristic	Cases	Percentage (%)
Gender		
Male	34	68
Female	16	32
Etiology		
Diabetic nephropathy	20	40
Hypertensive nephropathy	16	32
Unknown etiology	5	10
Habits		
Smoking	32	64
Tobacco	14	28
Alcohol	4	8
Complications		
Hypertension	33	66
Diabetes mellitus	24	48
Cardiovascular disease	29	58

Symptomatic Profile at Presentation

Gastrointestinal symptoms were the most frequent, with 40 patients (80%) experiencing nausea, vomiting, or anorexia. Signs of volume overload, such as pedal edema and dyspnea, were present in 26 patients (52%). Neurological manifestations included paresthesia in 29 (58%) and headache in 10 (20%). Pruritis was reported by 22 patients (44%). Urinary complaints were noted in 33 patients (66%).

Biochemical and Clinical Parameters

The majority of patients (38; 76%) were in **Stage 5 CKD** (eGFR <15 mL/min/1.73 m²). Eleven patients (22%) were at Stage 4, and only one (2%) at Stage 3.

Table 2. Key Biochemical Findings

Parameter	Mean ± SD	Abnormality	Prevalence
Hemoglobin	7.5 ± 1.56 g/dL	Anemia	48 (96%)
Serum phosphate	5.22 ± 1.45 mg/dL	Hyperphosphatemia	32 (64%)
Serum calcium	7.43 ± 0.92 mg/dL	Hypocalcemia	44 (88%)
Serum uric acid	7.16 ± 1.92 mg/dL	Hyperuricemia	21 males (61.8%), 13 females (81.2%)
Serum PTH	148.79 ± 96.74 pg/mL	Hyperparathyroidism	39 (78%)
Serum Vitamin D3	16.11 ± 7.15 ng/mL	Deficiency	47 (94%)
Serum Vitamin B12	345.73 ± 310.57 pg/mL	Deficiency	25 (50%)

Hematological Profile

Anemia was a prominent finding, with 48 patients (96%) having hemoglobin <11 g/dL and 19 (38%) below 7 g/dL. The mean corpuscular volume (MCV) was **79.78 ± 8.21 fL**, with 32 patients (64%) showing values <84 fL. The mean reticulocyte count was **1.73 ± 0.69%**.

Table X. Hematological Profile of CKD Patients (n = 50)

Parameter	Mean ± SD	Abnormality Criteria	Patients (n)	Percentage (%)
Hemoglobin	7.5 ± 1.56 g/dL	<11 g/dL	48	96
		<7 g/dL	19	38
Mean Corpuscular Volume	79.78 ± 8.21 fL	<84 fL	32	64
Reticulocyte count	1.73 ± 0.69 %	Low count	–	–

Renal Function

The mean serum urea was **144.56 ± 61.25 mg/dL**, with 30 patients (60%) in the 100–200 mg/dL range. The mean serum creatinine was **7.8 ± 3.53 mg/dL**, and the mean creatinine clearance was **12.29 ± 7.21 mL/min/1.73m²**.

Table X. Renal Function Profile of CKD Patients (n = 50)

Parameter	Mean ± SD	Observation Range	Patients (n)	Percentage (%)
Serum Urea	144.56 ± 61.25 mg/dL	100–200 mg/dL	30	60
Serum Creatinine	7.8 ± 3.53 mg/dL	–	–	–
Creatinine Clearance	12.29 ± 7.21 mL/min/1.73m²	–	–	–

Mineral and Bone Disorder

Hypocalcemia was observed in 44 patients (88%) and hyperphosphatemia in 32 (64%). Secondary hyperparathyroidism was detected in 39 patients (78%), and vitamin D deficiency in 47 (94%).

Table X. Mineral and Bone Disorder Profile of CKD Patients (n = 50)

Parameter	Abnormality Criteria	Patients (n)	Percentage (%)
Serum Calcium	Hypocalcemia (<8.5 mg/dL)	44	88
Serum Phosphate	Hyperphosphatemia (>4.5 mg/dL)	32	64
Serum PTH	Secondary hyperparathyroidism (>65 pg/mL)	39	78
Serum Vitamin D3	Deficiency (<31 ng/mL)	47	94

Quality of life:

In present study it shown that, the mean GQOL score of the study population was 50.56±11.66.

GQOL Score	Class	Percentage (%)
<30	1	2
30-45	20	40
46-60	20	40
61-75	9	18
>75	0	0

DISCUSSION:

In the present study, males (68%) outnumbered females (32%). This male predominance is consistent with the findings from the **CKD Registry of India (2013) (16)**, which reported 68.9% males and 31.3% females. **Rohan G Patil et al. (2015) (17)** and **Satnyan S et al. (2017) (18)** also documented a similar male predominance, though the ratio varied across cohorts. **Christopher Babua (2018) (19)** likewise observed a higher proportion of males. The greater vulnerability of men to CKD has been attributed to differences in lifestyle exposures, higher prevalence of smoking and alcohol use, and possible protective effects of estrogen in women.

In terms of etiology, diabetic nephropathy was the most common cause (40%), followed by hypertensive nephropathy (32%) and chronic glomerulonephritis (8%). This trend is in accordance with **Sharma M et al. (2018) (20)**, who reported diabetes mellitus as the cause of CKD in 42.2% of cases. Similarly, **Pathak A et al. (2016) (21)** observed diabetes and hypertension as the leading etiologies of CKD in their cohort. **Nirav et al. (2018) (22)** and **Xu et al. (2001) (23)** also found that nearly half of CKD cases were attributable to diabetes. This shift in etiology reflects the increasing burden of diabetes and hypertension in India, paralleling global epidemiological trends.

Regarding clinical manifestations, gastrointestinal symptoms such as nausea, vomiting, and anorexia were most frequent, affecting 80% of patients. Pedal edema was observed in 52%, while neurological symptoms including paresthesia and dyspnea were noted in 26%. These findings are similar to those of **Li et al. (2015) (24)**, who reported gastrointestinal symptoms in 81.5% and hypertension in 84% of CKD patients. **Rohan G Patil et al. (2015) (17)** also found pedal edema in 52% of their patients, in concordance with our study.

The prevalence of diabetes in the present study was 48%, aligning with **Rohan G Patil et al. (2015) (17)** who reported 52%. However, this was higher than the 24% reported by **Satnyan S et al. (2017) (18)** and 16.1% by **Christopher Babua (2018) (19)**. In our cohort, 70.8% of diabetics had disease duration of less than 10 years, contrasting with the **CKD Registry of India (2013) (16)**, where only 40.7% had diabetes for less than 10 years. Hypertension was observed in 66% of cases, comparable to 71% in the CKD Registry of India, though lower than 90% reported by **Christopher Babua (2018) (19)** and 72.6% by **Althnian (2016) (25)**.

Lifestyle habits were an important observation in this study. Smoking was present in 64% of patients, tobacco chewing in 28%, and alcohol use in 48%. These results are in agreement with **Nirav et al. (2018) (22)**, who found chronic tobacco use in 56% of cases. The **CKD Registry of India (2013) (16)** documented smoking in 32% and alcohol consumption in 6.4%. The much higher prevalence of substance use in our study highlights the importance of targeted interventions in lifestyle modification as a component of CKD care.

A striking observation was the advanced stage of disease at presentation, with 76% of patients in Stage 5 CKD (eGFR <15 ml/min/1.73 m²). This is similar to the **CKD Registry of India (2013) (16)**, which reported 70.3% of patients presenting in Stage 5. Late presentation is a common challenge in India due to limited awareness, socioeconomic constraints, and delayed referral.

Anemia was observed in 96% of our cohort, with mean hemoglobin 7.5 ± 1.56 g/dl. This finding is consistent with **McGonigle et al. (1984) (26)**, **Wallin et al. (1993) (27)**, and **Christopher Babua (2018) (19)**, who also reported anemia in the majority of CKD patients. Anemia in CKD is multifactorial, primarily due to decreased erythropoietin production, iron deficiency, and chronic inflammation, and significantly impacts morbidity, quality of life, and cardiovascular risk. Biochemical disturbances were frequent. Hyperphosphatemia was present in 74% of patients, with mean serum phosphate 5.22 ± 1.45 mg/dl. This aligns with findings of **Sarinak ML et al. (2010) (28)** and **Bansal et al. (2014) (29)**, who reported high prevalence of phosphate abnormalities among CKD patients. Serum magnesium was elevated in 60% of cases, with mean value 2.25 ± 0.58 mg/dl, contrasting with **Ahmed H. Mitwalli et al. (1996) (30)**, who reported a much lower prevalence (22.9%).

Endocrine and metabolic abnormalities were also notable. Low T3 syndrome was detected in 42%, overt hypothyroidism in 2%, and subclinical hypothyroidism in 2%. These results are similar to **Punehar J et al. (2013) (31)** and **Khatiwada et al. (2015) (32)**, who reported thyroid dysfunctions in a substantial proportion of CKD patients. Furthermore, vitamin deficiencies were highly prevalent: 50% had Vitamin B12 deficiency and 94% had Vitamin D deficiency. These findings corroborate reports by **Dandge et al. (2016) (33)** and **Ghosh SK et al. (2015) (34)**.

Cardiovascular disease was documented in 58% of patients, with left ventricular hypertrophy being the most frequent manifestation (42%) followed by ischemic heart disease (16%). The **CKD Registry of India (2013) (16)** similarly noted a high burden of cardiovascular complications. Cardiovascular morbidity is recognized as the leading cause of mortality among CKD patients, reinforcing the need for early diagnosis and aggressive management of risk factors.

Serum amylase abnormalities were seen in 62% of patients, with values either below 30 U/L or above 110 U/L. Similar observations were reported by **Royse VL et al. (1999) (35)** and **JB Keogh et al. (2001) (36)**, while **Bindu et al. (2017) (37)** found lower mean values of 84.2 ± 22.7 U/L.

Taken together, the findings of this study reveal a demographic profile, clinical spectrum, and biochemical abnormalities comparable with both national and international literature. The predominance of advanced disease at presentation, high prevalence of anemia, mineral bone disorder, thyroid and vitamin deficiencies, and cardiovascular complications highlight the multifactorial burden of CKD. Early detection, lifestyle modification, and comprehensive multidisciplinary management are essential to improve survival and quality of life in this vulnerable group.

Conclusion

The present cross-sectional study provides valuable insights into the demographic, clinical, and biochemical profile of chronic kidney disease (CKD) patients undergoing dialysis in South Gujarat. A clear male predominance was observed, with diabetic nephropathy and hypertensive nephropathy being the leading etiologies. Most patients presented at an advanced stage (Stage 5 CKD), reflecting late diagnosis and delayed access to healthcare services.

Anemia, gastrointestinal manifestations, and mineral bone disorders were highly prevalent, while significant proportions of patients demonstrated endocrine abnormalities such as thyroid dysfunction and deficiencies of Vitamin D and Vitamin

B12. Lifestyle factors including smoking, tobacco chewing, and alcohol use were common, further aggravating disease progression. Cardiovascular involvement, particularly left ventricular hypertrophy and ischemic heart disease, was frequently encountered, highlighting the strong cardio-renal link in this population.

Overall, the findings emphasize the urgent need for early screening and detection of CKD in high-risk individuals, aggressive management of diabetes and hypertension, lifestyle modification, and regular monitoring of biochemical and endocrine parameters. Strengthening preventive strategies, ensuring timely referral, and implementing a multidisciplinary approach can reduce disease burden, delay progression to end-stage renal disease, and improve survival and quality of life in CKD patients.

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