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Drug Utilization and Clinical Outcomes in Chronic Kidney Disease: A Study from the Southern Coastal Region of Tamil Nadu, India

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ABSTRACT

BACKGROUND Chronic Kidney Disease is a progressive and irreversible disorder characterized by gradual loss of renal function, contributing significantly to global morbidity and mortality. It is commonly associated with comorbidities such as hypertension and Type 2 Diabetes Mellitus and often remains undiagnosed until advanced stages, especially in developing countries like India. **OBJECTIVES** 1]To evaluate the socio-demographic characteristics of CKD patients. 2]To assess the clinical profile and associated comorbidities. 3]To determine the distribution of CKD stages among patients. 4]To analyze hemoglobin levels and prevalence of anemia. 5]To study prescribing patterns of antihypertensive and adjunctive medications. **METHODOLOGY** A retrospective observational study was conducted from November 2025 to April 2026 at a government medical college hospital in Nagapattinam, involving 150 confirmed CKD patients. Relevant clinical and demographic data were collected from medical records and analyzed. Patients aged ≥18 years with confirmed CKD (Stage 1–5) and complete records were included, while those with acute kidney injury, renal transplant, pregnancy, or incomplete data were excluded. **RESULTS** The study population showed a predominance of males (76.7%), with most patients in the 50–70 years age group. Hypertension (81.3%) and Type 2 Diabetes Mellitus (50%) were the most common comorbidities. A majority of patients (90%) were in Stage 5 CKD, indicating late-stage presentation. Moderate anemia (44%) and mild anemia (35%) were highly prevalent. Among antihypertensive drugs, calcium channel blockers (42%) and beta blockers (29.3%) were most commonly prescribed. Anti-ulcer agents (75.3%), CKD-specific drugs (58%), and cardiac medications (49.3%) were widely used. **CONCLUSION** The study highlights a high prevalence of advanced CKD, comorbid conditions, and anemia among patients. Late diagnosis emphasizes the need for early screening and timely intervention. Rational prescribing and comprehensive management are essential to improve patient outcomes and reduce disease progression.

Keywords : Chronic Kidney Disease, Hypertension, Type 2 Diabetes Mellitus, Anemia, Drug Utilization Pattern, End-Stage Renal Disease, Prescribing Pattern

INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible deterioration of renal function characterized by a gradual loss of the kidney's ability to maintain fluid, electrolyte, and metabolic homeostasis. It is defined by abnormalities of kidney structure or function persisting for more than three months, often identified by decreased glomerular filtration rate (GFR) or markers of kidney damage. Due to its asymptomatic nature in the early stages, CKD frequently remains undiagnosed until it reaches advanced stages, thereby contributing significantly to morbidity and mortality worldwide (1,2).

CKD has emerged as a major global public health problem, affecting approximately 10–13% of the population. The burden is particularly high in low- and middle-income countries due to increasing prevalence of non-communicable diseases, limited access to healthcare, and lack of awareness. In India, CKD prevalence is steadily rising due to rapid urbanization, sedentary lifestyle, dietary changes, and increased life expectancy (3–5).

Hypertension and Type 2 Diabetes Mellitus (T2DM) are the leading causes of CKD, accounting for the majority of cases globally. Chronic hyperglycemia and elevated blood pressure lead to progressive nephron damage, resulting in declining renal function over time.

Other contributing risk factors include obesity, smoking, aging, genetic predisposition, and exposure to nephrotoxic drugs (6–8).

CKD is classified into five stages based on GFR, with Stage 5 representing End-Stage Renal Disease (ESRD), where renal replacement therapy such as dialysis or kidney transplantation becomes essential for survival. Patients with advanced CKD often

present with complications such as anemia, cardiovascular diseases, electrolyte imbalances, metabolic acidosis, and bone mineral disorders, which significantly impact patient quality of life and survival (9–11).

Anemia is one of the most common complications of CKD, primarily caused by decreased erythropoietin production and impaired iron metabolism. It is associated with fatigue, reduced functional capacity, and increased cardiovascular risk. Effective management of anemia is crucial in improving clinical outcomes and quality of life in CKD patients (12,13).

Cardiovascular disease is the leading cause of mortality among CKD patients. The risk increases progressively with declining renal function due to factors such as endothelial dysfunction, inflammation, and vascular calcification. Early detection and management of cardiovascular risk factors are therefore essential components of CKD care (14,15).

Pharmacological management plays a key role in slowing disease progression and managing associated complications. Antihypertensive agents such as ACE inhibitors, angiotensin receptor blockers (ARBs), calcium channel blockers, beta blockers, and diuretics are widely used. In addition, adjunctive therapies including iron supplements, anti-diabetic agents, and gastroprotective drugs are commonly prescribed to address complications and comorbid conditions (16,17).

Drug therapy in CKD requires careful dose adjustment due to altered pharmacokinetics and reduced renal clearance. Inappropriate drug use can lead to adverse drug reactions and further deterioration of renal function. Therefore, rational prescribing and regular monitoring are essential in CKD management (18,19).

The present study aims to evaluate the socio-demographic characteristics, clinical profile, comorbidities, CKD staging, hemoglobin levels, and prescribing patterns among CKD patients in a tertiary care hospital. The findings are expected to provide valuable insights into disease burden, treatment practices, and areas for improvement in CKD management (5,20).

Understanding real-world prescribing patterns and clinical characteristics is crucial for optimizing therapeutic outcomes in CKD patients. Studies focusing on drug utilization and disease patterns help identify gaps in current practices and support the development of evidence-based strategies for better management. Such data are essential for improving patient care, reducing complications, and minimizing the overall healthcare burden associated with CKD (2,20).

INCLUSION CRITERIA

- Patients diagnosed with Chronic Kidney Disease (CKD) (Stage 1–5)
- Age ≥18 years (both genders)
- Patients with complete and documented medical records
- Patients receiving treatment for CKD and associated comorbidities
- Retrospective data available during the study period

EXCLUSION CRITERIA

- Patients with acute kidney injury (AKI)
- Age <18 years
- Pregnant or lactating women
- Patients with incomplete or missing records
- Renal transplant patients

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RESULTS

Table 1. Socio-demographic Characteristics of the Study Population

VARIABLE	CATEGORY	FREQUENCY (N=150)	PERCENTAGE %
GENDER	MALE	115	76.7 %
	FEMALE	35	23.3 %
AGE (YEARS)	20-30	9	6 %
	30-40	16.5	11 %
	40-50	28.5	19 %
	50-60	49.5	33 %
	60-70	36	24 %
	70-80	9	6 %
	80-90	1.5	1 %

Table 1. The socio-demographic analysis of the study population (N=150) showed a predominance of male patients (76.7%, n=115) compared to females (23.3%, n=35). Age distribution revealed that the majority of patients were in the 50–60 years age group (33%), followed by 60–70 years (24%) and 40–50 years (19%). Younger age groups such as 20–30 years and 30–40 years accounted for 6% and 11% respectively, while only 1% of patients were above 80 years. These findings indicate that CKD is more prevalent among middle-aged and elderly individuals (1,2).

Table 2. Clinical Profile, Comorbidities, and CKD Staging

CLINICAL PARAMETERS	CATEGORY	FREQUENCY (N=150)	PERCENTAGE %
COMORBIDITIES	HYPERTENSION	122	81.3 %
	TYPE 2 DM	75	50 %
	CAD	30	20 %
	ANEMIA	23	15.3 %
CKD STAGE (1-5)	STAGE 1	2	1.3 %
	STAGE 2	7	4.8 %
	STAGE 3	4	2.6 %
	STAGE 4	2	1.3 %
	STAGE 5 (ESRD)	135	90 %

Table 2. The clinical profile showed that hypertension was the most common comorbidity, present in 81.3% (n=122) of patients, followed by Type 2 Diabetes Mellitus in 50% (n=75). Coronary artery disease (20%, n=30) and anemia (15.3%, n=23) were also observed among the study population. CKD staging revealed that a vast majority of patients were in Stage 5 (ESRD), accounting for 90% (n=135), while only a small proportion were in earlier stages: Stage 1 (1.3%), Stage 2 (4.8%), Stage 3 (2.6%), and Stage 4 (1.3%). These findings indicate a high prevalence of comorbidities and late-stage presentation of CKD (1–3).

Table 3. Distribution of Hemoglobin Levels in CKD Patients

HEAMOGLOBIN RANGE (g/dl)	CLASSIFICATION	FREQUENCY (N=150)	PERCENTAGE %
3.0-5.9	SEVERE	15	10 %
6.0-8.9	MODERATE	66	44 %
9.0-11.9	MILD	53	35 %
12.0-14.9	NORMAL	16	11 %
≥15.0	ELEVATED	0	0

Table 3. The distribution of hemoglobin levels among CKD patients showed that the majority had moderate anemia (44%, n=66), followed by mild anemia (35%, n=53). Severe anemia was observed in 10% (n=15) of patients, while only 11% (n=16) had normal hemoglobin levels. No patients were found to have elevated hemoglobin levels. These findings indicate a high prevalence of anemia among CKD patients (1,2).

Table 4. Prescribing Patterns of Antihypertensive Drug Classes

DRUG CLASS	PRESCRIPTION	PERCENTAGE %
CALCIUM CHANNEL BLOCKERS	63	42 %
BETA BLOCKERS	44	29.3%
ALPHA BLOCKERS	17	11.3 %
DIURETICS	24	16 %
ANGIOTENSIN RECEPTOR BLOCKERS	24	16%
ACE INHIBITORS	2	1.3 %
OTHER ANTIHYPERTENSIVE	30	20%

Table 4. The prescribing pattern of antihypertensive drugs showed that calcium channel blockers were the most commonly used class (42%, n=63), followed by beta blockers (29.3%, n=44). Diuretics and angiotensin receptor blockers (ARBs) were each prescribed in 16% (n=24) of patients, while alpha blockers accounted for 11.3% (n=17). ACE inhibitors were least prescribed (1.3%, n=2). Other antihypertensive drugs were used in 20% (n=30) of cases.

This indicates a preference for safer and well-tolerated antihypertensive agents in CKD patients (1,2).

Table 5. Utilization Pattern of Non-Antihypertensive and Adjunctive Medications

MEDICATION CATEGORY	FREQUENCY (N=150)	PERCENTAGE
ANTI-ULCER AGENTS	113	75.3
CKD SPECIFIC DRUGS	87	58
CARDIAC	74	49.3
IORN SUPPLEMENTS	51	34
ANTI-DIABETICS	47	31.3
ANTIBIOTICS	47	31.3
ANALGESIC	19	12.6

Table 5. The utilization pattern of non-antihypertensive and adjunctive medications showed that anti-ulcer agents were the most commonly prescribed (75.3%, n=113), followed by CKD-specific drugs (58%, n=87) and cardiac medications (49.3%, n=74). Iron supplements were used in 34% (n=51) of patients, while anti-diabetic drugs and antibiotics were each prescribed in 31.3% (n=47). Analgesics were the least utilized (12.6%, n=19). These findings reflect the need for supportive therapy and management of comorbid conditions in CKD patients (1,2).

DISCUSSION

The present study evaluated the socio-demographic characteristics, clinical profile, comorbidities, laboratory findings, and prescribing patterns among CKD patients. The results showed a higher prevalence of CKD among males (76.7%) compared to females, which is consistent with previous studies suggesting increased risk in males due to lifestyle factors and higher prevalence of comorbid conditions (1,2). The age distribution indicated that most patients were in the 50–70 years age group, confirming that CKD is more common in middle- aged and elderly populations due to cumulative exposure to risk factors and age-related decline in renal function (3).

Hypertension (81.3%) and Type 2 Diabetes Mellitus (50%) were the most common comorbidities observed in this study. These findings are in line with existing literature identifying these conditions as the primary causes of CKD progression worldwide (2,4). The presence of coronary artery disease (20%) further supports the strong association between CKD and cardiovascular complications, which significantly contribute to morbidity and mortality (5).

A key finding of this study was that the majority of patients (90%) were in Stage 5 CKD (ESRD), indicating late presentation and delayed diagnosis. This trend is commonly observed in developing countries where limited awareness, inadequate screening, and poor access to healthcare result in patients seeking medical care only at advanced stages of the disease (1,6).

The analysis of hemoglobin levels revealed that most patients had moderate (44%) and mild (35%) anemia, with a smaller proportion having severe anemia (10%). This reflects the high burden of anemia in CKD patients, primarily due to decreased erythropoietin

production and altered iron metabolism. Anemia is known to worsen clinical outcomes and increase cardiovascular risk in CKD patients (7,8).

Regarding antihypertensive therapy, calcium channel blockers (42%) and beta blockers (29.3%) were the most commonly prescribed drugs. The lower use of ACE inhibitors (1.3%) may be attributed to concerns regarding adverse effects such as hyperkalemia and worsening renal function in advanced CKD. These findings suggest that clinicians prefer safer and better-tolerated drug classes in patients with severe renal impairment (9,10).

The utilization pattern of adjunctive medications showed that anti-ulcer agents (75.3%) were most frequently prescribed, followed by CKD-specific drugs (58%) and cardiac medications (49.3%). This reflects the need to manage gastrointestinal protection, CKD-related complications, and associated comorbidities. Iron supplementation (34%) was commonly used to treat anemia, while the lower use of analgesics (12.6%) may be due to the risk of nephrotoxicity (10,11).

Overall, the study highlights that CKD patients commonly present with advanced disease and multiple comorbidities, requiring comprehensive and multidisciplinary management. The findings emphasize the importance of early detection, appropriate pharmacological therapy, and regular monitoring to reduce disease progression and improve patient outcomes (2,6).

CONCLUSION

The present study concludes that Chronic Kidney Disease (CKD) is more prevalent among middle-aged and elderly individuals, with a higher predominance in males. The majority of patients were diagnosed at an advanced stage (Stage 5 CKD), indicating delayed detection and inadequate early screening practices (1,2). Hypertension and Type 2 Diabetes Mellitus were identified as the most common comorbidities, playing a major role in disease progression (2,3).

A high prevalence of anemia was observed among CKD patients, with most cases being moderate to mild in severity, highlighting the need for routine monitoring and timely intervention (4). The prescribing pattern showed that calcium channel blockers and beta blockers were the most commonly used antihypertensive agents, while ACE inhibitors were less frequently prescribed due to safety concerns in advanced CKD (5).

The use of adjunctive medications such as anti-ulcer agents, CKD-specific drugs, and cardiac medications reflects the importance of supportive therapy in managing complications and comorbid conditions. Overall, the findings emphasize the need for early diagnosis, effective management of risk factors, and rational drug utilization to slow CKD progression and improve patient outcomes (2,6).

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