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RESEARCH ARTICLE

A Retrospective Observational Study on Prescribing Patterns and Clinical Profile of Chronic Kidney Disease Patients in a Kidney Care Center in Dharmapuri, Tamil Nadu

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Abstract: Chronic Kidney Disease (CKD) is a formidable global health challenge, significantly contributing to morbidity and mortality rates, particularly in developing nations where the epidemiological transition has led to a surge in non-communicable diseases. The management of CKD, especially in its advanced stages, necessitates complex pharmacotherapeutic regimens to mitigate disease progression and manage sequelae such as anemia, mineral bone disorders, and cardiovascular instability. This retrospective observational study assessed the prescribing patterns, demographic distribution, and clinical profiles of 100 adult patients at a tertiary kidney care center in Dharmapuri, Tamil Nadu, over a six-month period. Analysis of medical records revealed a distinct male preponderance (77%) with the highest disease burden observed in the fifth and sixth decades of life. The clinical profile was dominated by late-stage presentation, with 90% of the cohort classified as having Stage 5 CKD (End-Stage Renal Disease). Hypertension (81%) and Type 2 Diabetes Mellitus (50%) were regarded as the primary etiological factors. Pharmacological analysis indicated that Calcium Channel Blockers (42%) were the primary antihypertensive agents, reflecting a preference for agents with neutral metabolic profiles in advanced renal failure. Polypharmacy was ubiquitous, evidenced by the extensive utilization of anti-ulcer agents (75%) and cardiac medications (49%). Moderate anemia was detected in a significant proportion of the study population, necessitating frequent erythropoiesis-stimulating agent and iron supplementation. These results show a critical delay in diagnosis and referral in rural Indian settings, necessitating urgent public health interventions.

Keywords: Chronic Kidney Disease; Pharmacovigilance; Antihypertensive Agents; Polypharmacy; Clinical Epidemiology

1. Introduction

The increasing burden of chronic kidney disease (CKD) is a significant global public health challenge. Physiologically, CKD is characterized by a progressive, irreversible decline in glomerular filtration rate (GFR) accompanied by structural renal damage persisting for more than three months [1]. While global prevalence estimates hover between 10% and 13%, the impact is disproportionately severe in low- and middle-income countries [2]. In the Indian context, the demographic shift towards an aging population, coupled with the rapid urbanization-induced rise in metabolic syndrome, has created a fertile ground for renal pathologies. Current epidemiological data suggest that diabetic nephropathy and hypertensive glomerulosclerosis account for nearly 45% of the total CKD burden in the subcontinent [3].

The clinical management of CKD is inherently complex. As renal clearance diminishes, the pharmacokinetic and pharmacodynamic parameters of administered drugs are significantly altered, necessitating meticulous dose adjustments to avoid toxicity [4]. Moreover, the therapeutic regimen is rarely monotherapeutic; patients typically require a multifaceted approach to manage not only the primary renal pathology but also the kaleidoscope of complications that arise from renal failure, including anemia, secondary hyperparathyroidism, electrolyte imbalances, and cardiovascular disease [5]. Consequently, patients with advanced CKD or End-Stage Renal Disease (ESRD) are frequently exposed to high pill burdens, often exceeding 10 medications per day. This prevalent polypharmacy elevates the risk of adverse drug reactions (ADRs) and drug-drug interactions, potentially compromising patient safety and adherence [6].

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Drug Utilization Research (DUR) serves as a vital tool in this context, providing a framework to evaluate the rationality of prescribing practices against established clinical guidelines such as those provided by KDIGO (Kidney Disease: Improving Global Outcomes) [7]. While numerous studies have documented prescribing patterns in metropolitan tertiary care centers, there remains a paucity of data regarding clinical profiles and therapeutic trends in semi-urban and rural healthcare settings in India. This gap is critical, as healthcare access and prescribing behaviors often vary significantly outside major urban hubs. Therefore, this study was designed to evaluate the demographic characteristics, comorbidity profiles, and pharmacotherapeutic patterns of CKD patients attending a secondary kidney care center in Dharmapuri, Tamil Nadu, to provide actionable information for optimizing renal care in this region.

2. Materials and Methods

2.1. Study Design

A retrospective, cross-sectional observational study was executed to evaluate the clinical and prescribing profiles of patients diagnosed with CKD. The research was conducted at the Secondary Kidney Care Centre in Dharmapuri, Tamil Nadu, a facility catering to a semi-urban and rural demographic. The study period involved six months, from March 2025 to September 2025, encompassing the review of patient medical records generated during this timeframe.

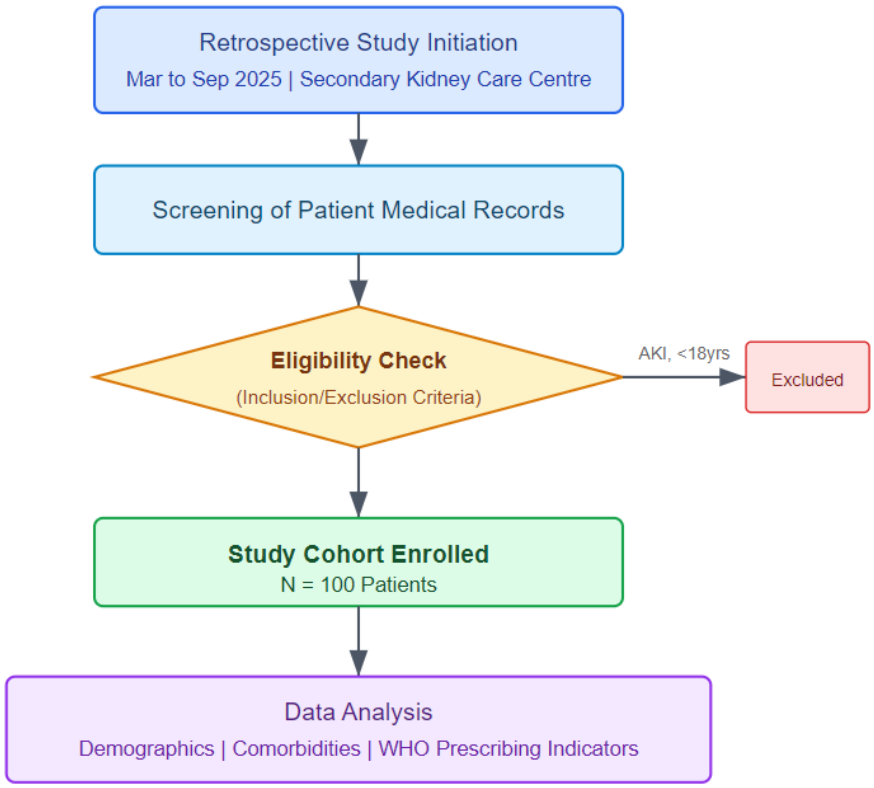

Figure 1. Study Methodology and Patient Selection Process.

2.2. Study Population and Sampling

The cohort consisted of 100 patients selected based on specific eligibility criteria. Inclusion was restricted to adult patients (aged 18 years and above) of any gender with a confirmed diagnosis of CKD who were prescribed a minimum of two medications per clinical encounter. The study included patients across all stages of CKD, including those on maintenance hemodialysis, regardless of the presence of comorbid conditions. Exclusion criteria were strictly applied to ensure data homogeneity; patients with acute kidney injury (AKI), those undergoing evaluation for renal transplantation, pregnant or lactating women, and individuals with cognitive impairments precluding consent or accurate history taking were omitted. Additionally, patients presenting primarily for surgical interventions such as nephrolithiasis or renal trauma were excluded to focus the analysis on medical management of chronic renal failure [8].

2.3. Data Collection and Ethics

Data extraction was performed using a structured proforma designed to capture a wide array of variables. Demographic details, including age and gender, were recorded alongside clinical histories detailing past medical conditions, surgical interventions, and family history of renal disease. Laboratory parameters, specifically serum creatinine and hemoglobin levels, were documented to stage the disease and assess complications like anemia. The medication profile was scrutinized to identify prescribing patterns, specifically focusing on antihypertensive classes, generic prescribing rates, and the utilization of adjunctive therapies. The study protocol received approval from the Institutional Ethics Committee (IEC). Given the non-interventional, retrospective nature of the study involving only medical record review, the requirement for active informed consent was waived by the committee, provided that strict patient confidentiality and data anonymity were maintained throughout the analysis [9].

2.4. Statistical Analysis

Collected data were subjected to descriptive statistical analysis. Continuous variables were categorized, and categorical variables were expressed as frequencies and percentages. The study focused on determining the distribution of various drug classes across the study population and correlating these patterns with clinical demographics [8-10].

3. Results

3.1. Demographic Characteristics

The analysis of the 100-patient cohort revealed a significant gender disparity, with 77% (n=77) of the population being male and 23% (n=23) female. Age distribution analysis indicated that CKD prevalence peaked in the middle-to-late adult years. The 50–60 year age group constituted the largest segment (33%), followed by the 60–70 year group (24%) and the 40–50 year group (19%). This clustering suggests that renal function decline in this population is strongly associated with middle age, likely correlating with the duration of underlying metabolic comorbidities [11]. Table 1 summarizes the socio-demographic characteristics of the study population.

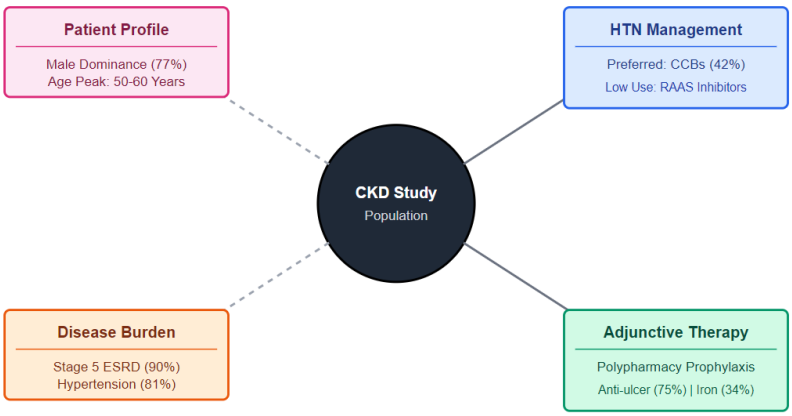

Figure 2. Main Demographic Characteristics in the Study Population

Table 1. Socio-demographic Characteristics of the Study Population (N=100)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	77	77%
	Female	23	23%
Age Group (Years)	20 – 30	6	6%
	30 – 40	11	11%
	40 – 50	19	19%
	50 – 60	33	33%
	60 – 70	24	24%
	70 – 80	6	6%
	80 – 90	1	1%

The comorbidity profile was dominated by cardiovascular and metabolic disorders. Hypertension was the most pervasive condition, affecting 81% of patients, followed by Type 2 Diabetes Mellitus in 50%. Coronary Artery Disease (CAD) was documented in 20% of the cohort. Crucially, the staging of CKD at the time of presentation was alarming; 90% of patients were classified as Stage 5 (ESRD), requiring renal replacement therapy or intensive conservative management. Early-stage disease (Stages 1–3) accounted for less than 10% of the study population, indicating late referral or diagnosis [12]. The detailed clinical profile and staging are presented in Table 2.

Table 2. Clinical Profile, Comorbidities, and CKD Staging (N=100)

Clinical Parameter	Category	Frequency (n)	Percentage (%)
Comorbidities	Hypertension	81	81%
	Type 2 Diabetes Mellitus	50	50%
	Coronary Artery Disease	20	20%
	Anemia (Documented History)	15	15%
CKD Stage	Stage 1	1	1%
	Stage 2	5	5%
	Stage 3	3	3%
	Stage 4	1	1%
	Stage 5 (ESRD)	90	90%

3.2. Hematological Profile

Anemia, a quintessential complication of chronic renal failure attributed to erythropoietin deficiency, was prevalent. Hematological analysis showed that 44% of patients had moderate anemia with hemoglobin levels ranging between 6.0 and 8.9 g/dL. Severe anemia (3.0–5.9 g/dL) was present in 10% of the cohort, while 35% maintained levels between 9.0 and 11.9 g/dL. No patients presented with hemoglobin levels exceeding 15.0 g/dL [13]. Table 3 shows the distribution of hemoglobin levels across the cohort.

Table 3. Distribution of Hemoglobin Levels in CKD Patients (N=100)

Hemoglobin Range (g/dL)	Classification	Frequency (n)	Percentage (%)
3.0 – 5.9	Severe Anemia	10	10%
6.0 – 8.9	Moderate Anemia	44	44%
9.0 – 11.9	Mild Anemia	35	35%
12.0 – 14.9	Normal / Near Normal	11	11%
≥ 15.0	Elevated	0	0%

3.3. Pharmacotherapeutic Patterns

3.3.1. Antihypertensive Utilization

Control of systemic hypertension is paramount in retarding CKD progression. The prescribing data revealed a distinct preference for Calcium Channel Blockers (CCBs), which were prescribed in 42% of cases. Beta-blockers followed as the second most common class (29%), with Alpha-blockers utilized in 11% of prescriptions. Notably, drugs acting on the Renin-Angiotensin-Aldosterone System (RAAS), specifically Angiotensin Receptor Blockers (ARBs) and Angiotensin-Converting Enzyme (ACE) inhibitors, were prescribed infrequently (6% and 1%, respectively). Diuretics were utilized in 6% of the encounters [14]. The prescribing frequencies of antihypertensive classes are shown in Table 4.

Table 4. Prescribing Patterns of Antihypertensive Drug Classes

Drug Class	Prescriptions (n)*	Percentage (%)
Calcium Channel Blockers (CCBs)	42	42%
Beta-Blockers	29	29%
Alpha-Blockers	11	11%
Diuretics	6	6%
Angiotensin Receptor Blockers (ARBs)	6	6%
ACE Inhibitors	1	1%
Other Antihypertensives	30	30%

Note: Patients may be prescribed more than one class of antihypertensive.

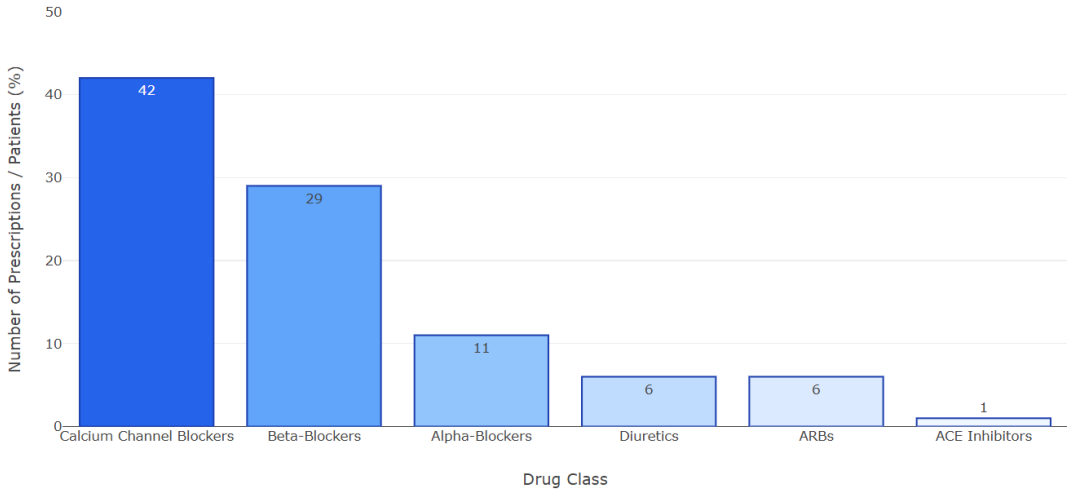

Figure 3. Prescribing Frequency of Antihypertensive Drug Classes
(Calcium Channel Blockers (CCBs) were the most frequently prescribed class (42%))

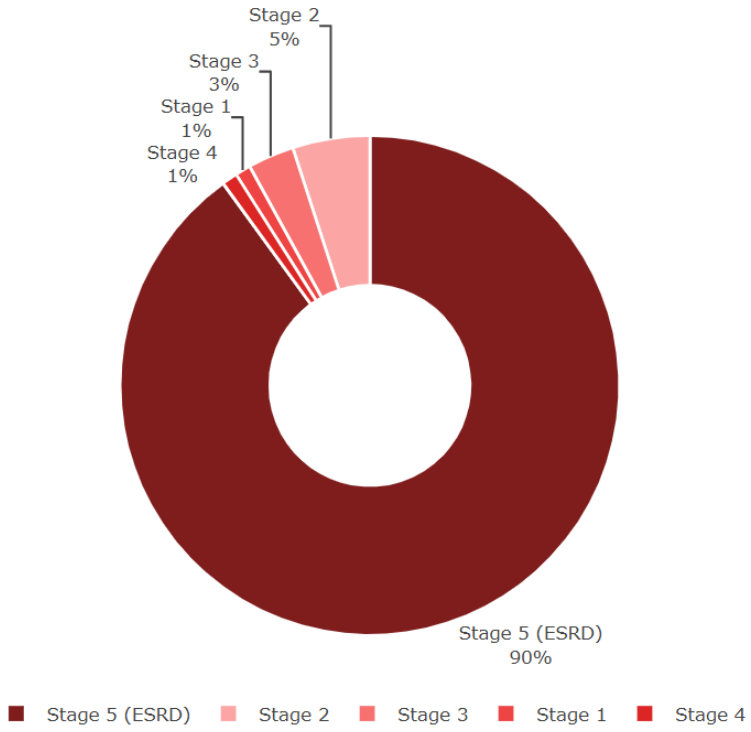

Figure 4. Distribution of Chronic Kidney Disease Stages at Presentation

3.3.2. Adjunctive and Comorbidity Management

Reflecting the complex clinical phenotype of the patients, polypharmacy was standard. Anti-ulcer agents (Proton Pump Inhibitors or H2 receptor antagonists) were the most frequently prescribed non-renal medication (75%), likely as prophylaxis against gastritis induced by uremia or concurrent medications. Cardiac glycosides and other cardiac-specific drugs were prescribed to 49% of patients, correlating with the high burden of cardiovascular disease [15].

Management of CKD-specific complications involved the use of phosphate binders, vitamin D analogs, and erythropoiesis-stimulating agents, grouped as "CKD-specific drugs," in 58% of patients. Iron supplementation was prescribed to 34% of the cohort to manage iron-deficiency anemia. Antibiotics and analgesics were each prescribed in 19% of cases, suggesting a significant burden of infection and pain management needs in this population [16]. Table 5 provides a breakdown of these ancillary medications.

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

Medication Category	Frequency (n)	Percentage (%)
Anti-ulcer agents	75	75%
CKD-specific drugs (Phosphate binders, Vit D)	58	58%
Cardiac drugs	49	49%
Iron supplements	34	34%
Anti-diabetic agents	31	31%
Antibiotics	19	19%
Analgesics	19	19%

4. Discussion

The findings of this retrospective study provide a window into the clinical reality of CKD management in a non-metropolitan Indian setting. The stark male predominance (77%) observed aligns with several national registries [8], potentially reflecting biological susceptibility but also likely pointing towards socio-economic factors where men may have better access to tertiary healthcare facilities compared to women in rural regions. The age distribution, peaking between 50 and 60 years, corroborates the natural history of diabetic and hypertensive nephropathy, which typically manifests as overt renal failure after decades of systemic disease [9]. A critical finding of this investigation is the overwhelming preponderance of Stage 5 CKD (90%) at presentation. This "crash landing" into ESRD suggests systemic failures in the primary and secondary care levels regarding screening and early detection [10]. Unlike developed healthcare systems where CKD is often managed from Stage 3 onwards, the patients in this cohort appear to be seeking specialized care only when renal replacement therapy becomes imminent. This delay drastically limits therapeutic windows for renoprotective strategies and is a common phenomenon in developing countries [11].

Pharmacologically, the preference for Calcium Channel Blockers (CCBs) over RAAS inhibitors differs from standard guidelines for early-stage CKD, where ACE inhibitors and ARBs are first-line therapies due to their antiproteinuric effects [9]. However, in the context of this specific cohort—predominantly Stage 5 patients—the reduced utilization of RAAS blockade is clinically justifiable. ACE inhibitors and ARBs carry a significant risk of inducing hyperkalemia and acute-on-chronic kidney injury in patients with severely reduced GFR [12]. CCBs offer potent blood pressure control without the metabolic risks associated with RAAS blockade in ESRD, explaining their high utilization rate in this specific setting [13]. The ubiquitous presence of polypharmacy, while necessary, raises concerns regarding pill burden and adherence [14]. The high prescription rate of anti-ulcer medications (75%) warrants scrutiny to ensure they are being used for active indications rather than indefinite prophylaxis, which contributes to pill burden without clear benefit [15]. Similarly, the prevalence of anemia (44% moderate, 10% severe) underscores the need for aggressive management of hemoglobin levels to improve quality of life and reduce cardiovascular mortality [16]. The fact that only 34% of patients were on iron supplements suggests a potential gap in the aggressive management of renal anemia, necessitating adherence to established anemia management protocols [17]. Combination care models involving clinical pharmacists could prove instrumental in conducting medication reviews to mitigate the risks associated with the complex drug regimens inherent to nephrology practice [18].

5. Conclusion

The clinical profile of CKD patients in the Dharmapuri region is characterized by advanced disease presentation, with the vast majority of patients presenting at Stage 5. The pharmacotherapeutic management is appropriately aggressive regarding cardiovascular stability, with a heavy reliance on Calcium Channel Blockers and cardiac medications. However, the study highlights critical areas for systemic improvement: specifically, the need for earlier detection of renal dysfunction at the primary care level to prevent the progression to ESRD. Moreover, while prescribing patterns largely align with the safety requirements of advanced renal failure, continuous monitoring of polypharmacy and optimization of anemia management protocols are essential to enhance clinical outcomes.

Compliance with ethical standards

Acknowledgements

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Conflict of interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Statement of ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Institutional Ethics Committee (IEC) of Sri Lakshminarayan College of Pharmacy.

Statement of informed consent

The requirement for active informed consent was waived by the Institutional Ethics Committee (IEC) due to the retrospective, non-interventional nature of the study, which involved the analysis of anonymized historical medical records.

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