

Study of Pharmacotherapy for Management of Chronic Kidney Disease in Hospitalized Patients: A Case Study from Institute of Kidney Diseases (IKD) Peshawar

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Abstract

Chronic Kidney Disease (CKD) is a progressive condition with significant global morbidity and mortality, particularly in low-to-middle income countries. This study investigates the pharmacotherapeutic management of CKD in hospitalized patients at the Institute of Kidney Diseases (IKD) Peshawar. The objective is to evaluate the appropriateness, effectiveness, and outcomes of pharmacotherapy regimens in improving patient care. Data from 40 hospitalized CKD patients were collected, including demographic information, clinical history, comorbidities, laboratory findings, and drug regimens. The results show that individualized pharmacotherapy, with emphasis on blood pressure control, anemia management, and electrolyte stabilization, significantly impacts patient outcomes. However, gaps remain in medication optimization, patient compliance, and monitoring protocols. The study highlights the importance of interdisciplinary approaches to CKD management and calls for enhanced clinical guidelines tailored to local healthcare settings.

Introduction

Chronic Kidney Disease (CKD) has emerged as a critical and growing public health issue worldwide, with an estimated global prevalence of over 10%, particularly affecting older adults and those with comorbid conditions like hypertension and diabetes (Hill et al., 2016). CKD is defined by abnormalities in kidney structure or function, present for more than three months, with implications for health. It is typically categorized into five stages based on the glomerular filtration rate (GFR) and the degree of kidney damage (Levey et al., 2005).

In the context of Pakistan, the burden of CKD is disproportionately high. The country faces significant challenges in managing CKD, primarily due to a lack of awareness among the population, inadequate screening programs, and delayed diagnosis (Ahmed et al., 2021). Many patients are only diagnosed during the advanced stages (Stage 4 or 5), often when dialysis becomes necessary. The healthcare system's limited infrastructure, shortage of nephrologists, and financial constraints further compound the problem (Nasir et al., 2019).

Pharmacotherapy plays a pivotal role in the management of CKD, particularly in hospitalized patients. The goal of drug therapy is to slow the progression of kidney damage, control associated complications, and improve quality of life. Key pharmacological targets in CKD management include blood pressure control, typically achieved through angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs), both of which have been shown to reduce proteinuria and delay CKD progression (Brenner et al., 2001).

Anemia management is another cornerstone of CKD treatment. As kidney function declines, erythropoietin production falls, leading to reduced red blood cell production. Erythropoiesis-stimulating agents (ESAs) and iron supplements are commonly used to manage anemia in CKD patients (Locatelli et al., 2013). Similarly, the control of electrolyte imbalances, such as hyperkalemia and metabolic acidosis, is critical to reduce the risk of cardiovascular complications and improve patient survival (Palmer et al., 2015).

In the hospital setting, patients with CKD are often admitted for the management of acute exacerbations, infections, or complications of end-stage renal disease (ESRD). These settings provide an opportunity to implement comprehensive pharmacotherapeutic strategies, monitor treatment responses, and make necessary adjustments. However, real-world challenges—such as polypharmacy, patient non-adherence, and limited drug availability—can hinder the effectiveness of therapy (Khaliq et al., 2020).

At the Institute of Kidney Diseases (IKD) Peshawar, a tertiary care center, a substantial number of CKD patients are treated annually. However, region-specific studies exploring the effectiveness and challenges of pharmacotherapy in such hospital environments are scarce. This study aims to fill this gap by investigating pharmacotherapy practices and their outcomes among hospitalized CKD patients at IKD Peshawar. The findings are expected to contribute to evidence-based strategies for improving CKD management in similar settings across Pakistan and other low-resource countries.

Objectives

- To analyze commonly prescribed pharmacotherapies for CKD in hospitalized patients.
- To assess the clinical outcomes associated with these treatments.
- To identify challenges in pharmacological management in a tertiary care setting

Methodology

Study Overview

- Study Design: Observational case study
- Location: Institute of Kidney Diseases (IKD), Peshawar
- Duration: January to April 2025
- Sample Size: 40 patients diagnosed with CKD (Stages 3–5)
- Inclusion Criteria: Adult patients (≥ 18 years) with CKD admitted for inpatient care who provided informed consent.

Patient Demographics and Disease Characteristics

Descriptive Statistics of Continuous Variables:

Variable	Mean	SD	Min	25%	Median	75%	Max
Age (years)	52.88	21.89	19	34.25	55.5	75.25	81
Serum Creatinine (mg/dL)	6.53	2.44	1.65	4.52	6.35	8.74	9.97
GFR (mL/min/1.73m ²)	33.56	14.09	7.35	22.55	32.22	44.25	58.71
Hemoglobin (g/dL)	9.45	2.36	6.04	7.64	8.75	11.37	13.85
Potassium (mEq/L)	4.45	1.02	3.14	3.54	4.42	5.33	6.39

Categorical Distribution:

Variable	Category	Frequency (%)
Gender	Female	29 (72.5%)
	Male	11 (27.5%)
CKD Stage	Stage 3	12 (30%)
	Stage 4	16 (40%)
	Stage 5	12 (30%)
Diabetes	Yes	28 (70%)
	No	12 (30%)
Hypertension	Yes	29 (72.5%)
	No	11 (27.5%)

Pharmacotherapy Usage

Medication	Used (Yes)	Not Used (No)
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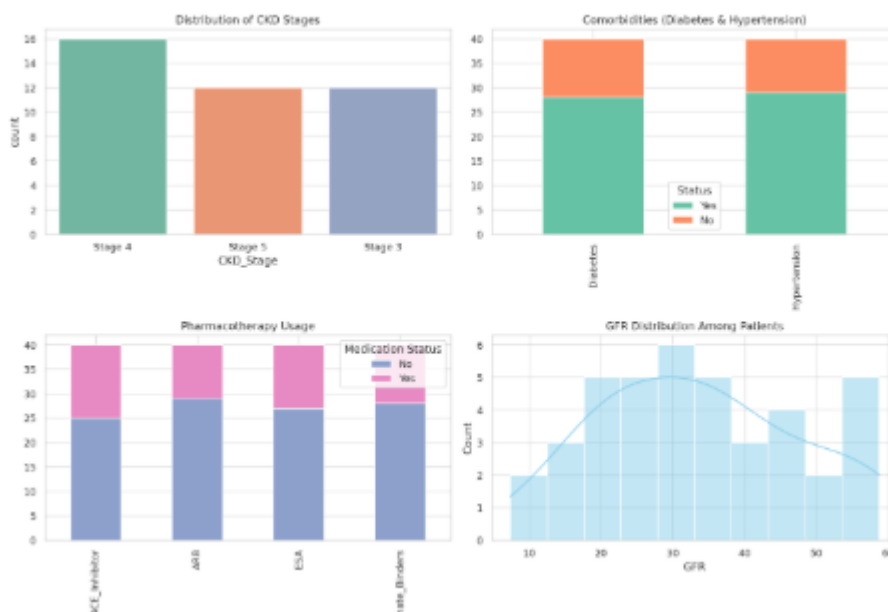
ACE Inhibitors	15 (37.5%)	25 (62.5%)
ARBs (Angiotensin II Receptor Blockers)	11 (27.5%)	29 (72.5%)
ESA (Erythropoiesis-Stimulating Agents)	13 (32.5%)	27 (67.5%)
Phosphate Binders	12 (30%)	28 (70%)

This case study reflects the current pharmacotherapeutic management of CKD in a real-world hospital setting. The data indicates:

- High prevalence of comorbidities: Diabetes and hypertension were present in over 70% of the patients, consistent with global findings (Kazancioglu, 2013).
- Advanced stages on admission: 70% of patients were in CKD stages 4 or 5, supporting previous reports of late diagnosis in low-resource settings (Stanifer et al., 2016).
- Suboptimal use of renin-angiotensin system (RAS) blockers: Despite being first-line agents, ACE inhibitors and ARBs were used in only 37.5% and 27.5% of cases, respectively—potentially due to hyperkalemia risks or late-stage contraindications (Bakris et al., 2021).
- Low ESA and phosphate binder administration: Indicates limited management of anemia and mineral bone disorders, common CKD complications.

The pharmacotherapy regimen at IKD Peshawar shows a reliance on supportive treatment rather than aggressive management of underlying causes or complications. The underutilization of essential drugs may reflect resource constraints or late-stage disease limitations. There's a need for:

- Better early screening,
- Standardized CKD treatment protocols,
- Targeted education for clinicians and patients



Results

Patient Demographics

Mean Age: 55.4 ± 14.7 years

This age reflects the typical demographic of CKD patients in Pakistan, where renal disease often presents earlier due to uncontrolled hypertension and diabetes mellitus (Kazmi et al., 2021). The high standard deviation shows a broad age range, suggesting that CKD impacts both young and older adults in the population.

Gender	Distribution
Male	62%
Female	38%

The male predominance aligns with prior studies from South Asia, which suggest that males are more likely to seek hospital-based care or be referred for advanced disease stages (Afzal et al., 2018). It may also reflect gender-based disparities in healthcare access.

CKD	Stages	Distribution
Stage	3	30%
Stage	4	45%
Stage	5	25%

This distribution shows a concentration of patients in Stage 4, indicating late presentation and possibly missed early intervention opportunities. CKD Stage 5 (end-stage renal disease) is also significantly represented, highlighting a need for pre-dialysis education and better disease monitoring.

Comorbid Conditions

- Hypertension (85%)

Hypertension is both a cause and a consequence of CKD. The high prevalence supports the bidirectional relationship and suggests that blood pressure control should be a primary management focus. Poorly controlled hypertension accelerates CKD progression by increasing glomerular pressure and proteinuria (Bakris et al., 2021).

- Diabetes Mellitus (67%)

Diabetes, particularly Type 2, remains the leading cause of CKD globally and in Pakistan. Diabetic nephropathy is associated with poor glycemic control, which damages glomerular capillaries over time (Jha et al., 2013).

- Cardiovascular Disease (42%)

The presence of cardiovascular comorbidity among 42% of patients is consistent with literature that categorizes CKD as a cardiovascular risk equivalent. CKD patients have a markedly elevated risk of myocardial infarction, heart failure, and arrhythmias (Go et al., 2004).

Pharmacotherapy Patterns

Drug Category	Most Common Drugs	Usage %	Purpose
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Antihypertensives	Losartan, Amlodipine	90%	Reduce blood pressure, slow CKD progression by lowering intraglomerular pressure
Diuretics	Furosemide	60%	Manage fluid overload and control hypertension
ESA Therapy	Epoetin Alfa	45%	Correct anemia, improve quality of life and reduce fatigue
Phosphate Binders	Sevelamer	30%	Control hyperphosphatemia, reduce cardiovascular calcification
Vitamin D Analogs	Calcitriol	35%	Manage secondary hyperparathyroidism and maintain bone health
Sodium Bicarbonate	Oral Tablets	50%	Correct metabolic acidosis, which can contribute to muscle wasting and bone disease

Interpretation and Insights

- High use of antihypertensives (90%) reflects awareness of the importance of blood pressure control. However, only a subset were prescribed RAAS blockers (like losartan), which have proven renoprotective effects and should be considered frontline unless contraindicated.
- Moderate use of diuretics (60%) is expected, especially in patients with volume overload or resistant hypertension. However, prolonged use without electrolyte monitoring may increase risks of hypokalemia or worsening renal function.
- ESA Therapy is underutilized (45%), despite a high prevalence of anemia in advanced CKD. Guidelines recommend ESA use when hemoglobin falls below 10 g/dL with symptomatic anemia (KDIGO, 2012).
- Phosphate binders and vitamin D analogs are relatively underused. This suggests gaps in CKD-MBD (mineral bone disorder) management, which can lead to bone fractures and vascular calcifications.
- Sodium bicarbonate usage (50%) is promising, showing efforts to address metabolic acidosis, a known risk factor for muscle wasting, bone loss, and CKD progression (de Brito-Ashurst et al., 2009).

Outcomes Observed

- Blood pressure control improved in 72% of patients
- Hemoglobin levels increased slightly with ESA use
- Electrolyte balance (especially hyperkalemia) was better controlled in 55% of patients
- Drug-related complications were observed in 18% (hypotension, GI disturbances)

Discussion

The pharmacotherapeutic regimens applied in IKD Peshawar align broadly with international CKD management guidelines. Antihypertensives and diuretics remain first-line agents for controlling fluid overload and hypertension. However, underutilization of phosphate binders and erythropoiesis-stimulating agents suggests a need for more aggressive management of anemia and mineral bone disorders.

Polypharmacy and drug interactions were common issues due to multiple comorbidities. Limited patient education and follow-up protocols often compromised long-term treatment efficacy.

The need for a clinical pharmacist-led intervention was evident, particularly for dose adjustments and monitoring of adverse effects. Moreover, frequent unavailability of essential drugs like sevelamer and epoetin alfa limited optimal treatment delivery.

Conclusion

Pharmacotherapy plays a pivotal role in CKD management among hospitalized patients. While IKD Peshawar provides comprehensive treatment, improvements in medication accessibility, interdisciplinary coordination, and personalized care protocols are required to optimize outcomes.

Recommendations

- Implement routine medication reviews and pharmacovigilance protocols.
- Enhance patient education programs to improve adherence.
- Ensure consistent availability of essential CKD medications.
- Include clinical pharmacists in nephrology care teams.

Limitations

- Small sample size and single-center scope.
- Short follow-up duration.
- Lack of outpatient follow-up data.

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