



Assessment of Prescribing Pattern and Drug-Related Problems in Patients of Chronic Kidney Disease: A Cross-Sectional Study

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ABSTRACT

Background: Chronic kidney disease (CKD) is a significant health concern in India, with a prevalence of 17.2%. The increasing incidence of hypertension and diabetes contributes to the rising CKD cases. Early treatment focuses on managing underlying conditions, but as CKD progresses, patients often require multiple medications, leading to high treatment costs and potential drug-related problems (DRPs).

Objective: The study aims to investigate prescribing patterns and identify DRPs among CKD patients in India.

Methods: A cross-sectional study was conducted at the Department of Pharmacology, IGIMS, Patna, involving in-patients diagnosed with CKD. Data were collected through routine ward rounds and patient records, focusing on prescribing patterns and DRPs classified using the PCNE system. Descriptive statistics were employed for analysis.

Results: Out of 557 monitored patients, 203 (36.44%) experienced at least one DRP. The majority were males aged 41-60 years, with hypertension (89.66%) and diabetes (29.56%) as the most common comorbidities. Most patients were prescribed more than five drugs (91.13%), with antihypertensives being the most frequently prescribed class. A total of 428 DRPs were identified, with drug interactions (60.05%) being the most prevalent issue.

Conclusion: Polypharmacy is common among CKD patients, with antihypertensives being the most prescribed. DRPs, particularly drug interactions and frequency errors, are prevalent and require careful management. The integration of clinical pharmacologists and pharmacists into patient care teams is essential for addressing these challenges and enhancing patient outcomes.

Keywords: Chronic Kidney Disease, Drug-Related Problems, Prescribing Patterns, Polypharmacy, Drug Interaction, ADR.

INTRODUCTION

The Kidney Disease Outcomes Quality Initiative (KDOQI) of the National Kidney Foundation, characterizes chronic kidney disease (CKD) as either renal impairment or a diminished glomerular filtration rate (GFR) of less than 60 mL/min/1.73 m² persisting for three or more months.^{1, 2} A recently published meta-analysis and systematic review revealed the significant prevalence of CKD in India, estimated at 17.2%.³ The emergence of India as a prominent reservoir of CKD might be ascribed to the increasing incidence of hypertension and diabetes.⁴

In the initial phases of CKD, treatment is primarily focused on addressing the underlying diseases (such as diabetes and hypertension) and mitigating the progression of CKD. As kidney function declines, many drugs are prescribed to address related problems including mineral and bone abnormalities, anaemia, dyslipidaemia, as well as cardiovascular consequences. Upon reaching end-stage renal illness, the patient may necessitate 10 to 12 drugs.⁵

The cost of treatment is too high and inaccessible for more than 90 percent of patients across India. The administration

of several medications, along with poor adherence to treatment regimens, may lead to "drug-related problems (DRPs)."

A DRP is an incident or situation concerning drug therapy that either actually or potentially disrupts intended health outcomes. These may prevent or hinder patients from attaining their desired treatment objectives.⁶ Medication errors as well as "adverse drug reactions (ADRs)" constitute the primary components of drug-related problems (DRPs). Patients who are hospitalized are more susceptible to drug-related problems (DRPs), resulting in heightened adverse drug effects, as seen by prolonged hospital stays, higher healthcare consumption, and elevated expenses.⁷

Awareness of DRPs can facilitate the identification, resolution, and prevention of prospective DRPs, serving as a prerequisite for enhanced patient care.⁸ Prescribing patterns vary across different physicians, medical conditions, and patient populations, necessitating the examination of drug consumption over time.⁹

Studies on prescribing patterns in CKD can suggest modifications in prescribing procedures to enhance medical care. The judicious selection of medication ensures



maximum advantages for patients while reducing drug-related problems (DRPs).¹⁰

The study aim was to investigate the prevalent factors that provide an efficient template for best practice in prescribing patterns and drug-related problems (DRPs) among patients with chronic kidney disease (CKD). This hypothesis is based on the assumption that a large portion of CKD patients may experience inappropriate prescribing and drug-related problems which likely impact their clinical outcomes. The objective of this study is to conduct a systematic assessment and characterization of these patterns and problems, providing evidence that could potentially improve medication management and patient care in CKD. The cross-sectional study analyzes data to identify particular areas of prescribing practice and potential targets for improvement in order to decrease drug-related consequences in this high-risk patient group.

In the Indian subcontinent, there is no comprehensive representation of the drug profile in patients with CKD. This study aims to evaluate physicians' patterns of prescribing as well as to identify and characterize the diverse drug-related problems associated with therapy in chronic kidney disease patients.

MATERIALS & METHODS

A cross-sectional study was carried out in Department of Pharmacology with data from in-patient Department of Nephrology of IGIMS, Patna. Study was started after taking approval from Institutional Ethics Committed of IGIMS, Patna (vide letter no: 998/IEC/IGIMS/2023). Informed consent was taken from patients with CKD.

Inclusion Criteria: Patients diagnosed with CKD as per KDIGO guidelines admitted in in-patient department of nephrology.

Exclusion Criteria: Patients of out-patient department or pregnant and breastfeeding women.

Data Collection: Routine ward rounds were conducted, and patient characteristics were assessed. Data derived from patient records as well as nursing charts were recorded and examined for prescribing patterns and drug-related problems (DRPs).

Classification of Drug-Related Problems (DRPs): The PCNE system is systematically organized and widely acknowledged across multiple areas, featuring specific protocols for drug-related issues, their origins, and possible solutions. In this context, the PCNE classification system was employed for the identification and categorization of DRPs.¹¹

Classification of Drug Related Problem (PCNE):¹²

- **“ADR:** Hypoglycaemia, gastrointestinal disturbances, cough, muscle ache and cramps, dizziness, and others.
- **Drug choice problems:** Inappropriate drug, inappropriate duplication, contraindication, drug use without indication, no drug prescribed but clear

indication, inadequate regimen, and drug not required but repeated.

- **Dosing problems:** Dose too low or frequency not enough, dose too high or frequency too often, duration of treatment too short, duration of treatment too long, and inappropriate dosing.
- **Drug use problems:** Drug not taken or administered at all, incorrect administration, and nonadherence to medication.
- **Drug interaction:** Potential interaction.
- **Others:** Insufficient awareness/knowledge, unclear complaints, therapy failure, worries about complications/ADR, dispensing issues, lifestyle modifications, monitoring for side effects, and technical issues.”¹²

Statistical Analysis: Data related to prescribing pattern and drug related problems were represented in a tabular form using Microsoft Excel 2021. Descriptive statistics were used to represent the frequency and percentage of prescribing pattern and categories of drug related problems.

RESULTS

A total of 557 paediatric patients were monitored during the study period (January 1 to June 30, 2024). Of these 557 patients, 203 patients (36.44%, 203/557) had at least one DRP and were thus included in the study.

Table 1: Distribution of CKD Patients with respect to Age and Gender

| Age (years) | Number of patients (n=203), n (%) | |
|-------------|-----------------------------------|------------|
| | Males | Females |
| <20 | 5 (2.46) | 4 (1.97) |
| 21-40 | 39 (19.21) | 10 (4.93) |
| 41-60 | 67 (33.00) | 28 (13.79) |
| 61-80 | 29 (14.29) | 17 (8.37) |
| >80 | 4 (1.97) | 0 |

It is observed from Table 1 that more than half of the CKD patients are in the mid-age group, with the majority being male (33%) and female (13.79%) aged between 41-60 years. There are fewer patients under the age of 20 or over the age of 80, emphasizing that, at least for those two intervals, more men most likely have CKD between these ages.

Table 2: Prevalence of Co-morbidities in Patients with CKD

| Comorbidities | Number of patients (n=203), n (%) |
|------------------------------------|-----------------------------------|
| Hypertension | 182 (89.66) |
| Diabetes mellitus | 60 (29.56) |
| Anemia | 23 (11.33) |
| Ischemic heart disease | 19 (9.36) |
| Hypothyroidism | 9 (4.43) |
| Lower respiratory tract infections | 6 (2.96) |
| Others | 36 (17.73) |



According to Table 2, with a total of 89.66% of the sample that suffers from CKD, hypertension is the most encountered comorbidity. Commonness of other conditions were diabetes mellitus (29.56%), anaemia (11.33%) and ischemic heart disease (9.36%). Hypothyroidism, other lower respiratory tract infections and others are less common comorbidities that comprise a smaller fraction of patients.

Table 3: Frequency of Drugs prescribed per Patient

| Number of drugs | Number of patients (n=203), n (%) |
|-----------------|-----------------------------------|
| 1 | 0 |
| 1 to 5 | 18 (8.87) |
| More than 5 | 185 (91.13) |

As seen in table 3 CKD patients are mostly placed on more than five drugs (91.13%) while some on one to five drugs only (8.87%), and none use only one drug system. This with a high rate of polypharmacy among the patients.

Table 4: Prescribing Pattern of Different Classes of Drugs in CKD Patients

| Drug category | Number of patients (n=203), n (%) |
|-----------------------|-----------------------------------|
| Antihypertensives | 182 (89.66) |
| Antidiabetics | 56 (27.59) |
| Phosphate binders | 18 (8.87) |
| Iron supplements | 71 (34.98) |
| Vitamin D supplements | 28 (13.79) |
| Statins | 19 (9.36) |
| Antiplatelets | 42 (20.69) |
| Antibiotics | 44 (21.67) |
| Others | 32 (15.76) |

Table 5: Distribution of Various Categories of Drug Related Problems

| Drug-related problems | Number of prescriptions (n=428), n (%) |
|-------------------------|----------------------------------------|
| ADR | 5 (1.17) |
| Inappropriate drug | 5 (1.17) |
| Drug without indication | 4 (0.93) |
| Indication without drug | 48 (11.21) |
| Frequency error | 50 (11.68) |
| Contraindications | 14 (3.27) |
| Too high dose | 18 (4.21) |
| Dose adjustment | 13 (3.04) |
| Drug interactions | 257 (60.05) |
| Drug duplication | 5 (1.17) |
| Insufficient awareness | 5 (1.17) |
| Worries about ADR | 5 (1.17) |

As can be seen in Table 4, the drug class with the highest prescription rate for CKD patients was antihypertensives (89.66%), followed by iron supplements (34.98%) and antidiabetics (27.59%). Antiplatelets (20.69%) and antibiotics (21.67%) are among the most commonly prescribed drugs. A handful of others, for example statins, vitamin D supplements and phosphate binders are less widely used.

A total of 428 DRPs were detected in 203 patients with average of 2.11 DRP per patients.

Drug interaction is the most common problem (60.05) in prescriptions. More recently, frequency errors were the most common (11.68%), followed by indications without drugs (11.21%) and high doses (4 21%). Inappropriate drugs, ADRs, drug duplications and lack of awareness are less frequent issues with 1.17% each. [Table 5]

DISCUSSION

In this study involving 203 patients, one-third were in the 51–60 years age bracket. This aligns with the research undertaken by Rani et al.,¹³ wherein the majority of patients were in the 41–60 years age bracket. The incidence of CKD is anticipated to rise with advancing age. This phenomenon can also be attributed to the diminished life expectancy within the CKD community, leading to a lower percentage of patients aging 80 years and older.¹³⁻¹⁵

This study identified hypertension, type 2 diabetes mellitus, along with anaemia as the primary comorbidities. This aligns with the findings of a research by Rani et al.,¹³ which identified hypertension, diabetes mellitus, along with coronary artery disease as the primary comorbidities. The prevalence of CKD is elevated in patients with various comorbidities.¹⁰ Diabetes as well as hypertension are recognized as disorders that contribute to the onset and advancement of CKD, hence corroborating the high frequency of these ailments in the research population.¹⁶ The numerous comorbidities and consequences associated with CKD elevate the likelihood of polypharmacy. The majority of chronic kidney disease patients exhibit hypertension as the predominant comorbidity. The association between hypertension with chronic kidney disease is reciprocal. Unregulated hypertension, a potential risk factor for CKD, correlates with an accelerated course of CKD. Progressive renal illness might worsen chronic hypertension due to fluid overload and heightened systemic vascular resistance.¹³

Diuretics were the most utilized medication in the study population, succeeded by "calcium-channel blockers (CCBs), alpha-agonists, and alpha-blockers." This resembled a research by Bajait et al.,² which indicated a higher utilization of diuretics compared to CCBs. Diuretics are essential in chronic kidney disease for managing extracellular fluid volume increase and its consequent impact on blood pressure. Fluid retention is a consequence of hypertension in patients with CKD.²

Patients necessitate diuretics to lower blood pressure and manage fluid overload. Loop diuretics, such as torsemide and furosemide, are utilized more frequently than thiazide diuretics. The former is advised for the last phases (phases 4 and 5), while the latter is suggested for the first stages (Stages 1–3) as per KDOQI guidelines. All thiazide diuretics, with the exception of metolazone, are ineffective in chronic kidney disease stages 4 and 5 because thiazides cannot access the site of action. This study utilized "torsemide, furosemide, and metolazone" as diuretics for patients with chronic kidney disease (CKD). Metoprolol is the sole prescription beta-blocker. It is lipid-soluble and does not necessitate dosage modification, making it favourable in chronic kidney disease (CKD).¹⁷

Nonetheless, beta-blockers are least favoured in chronic kidney disease patients with diabetes as they obscure the symptoms of hypoglycaemia. "Angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs)," which are the recommended medications in the early phases of chronic kidney disease (CKD), may induce hyperkalaemia in the advanced stages of CKD. Dosage modification is necessary for ACE inhibitors and angiotensin receptor blockers in CKD due to changed pharmacokinetic characteristics. Consequently, these medications are least favoured in the terminal phases of chronic kidney disease (CKD). To diminish proteinuria, ACE inhibitors and angiotensin receptor blockers are favoured over other medications due to their ability to lower "intra-osmotic pressure in Bowman's capsule."²

In this study, 27.59% of patients received prescriptions for antidiabetic medicines. Insulin remained the most often recommended antidiabetic medication compared to oral hypoglycaemic agents. This resembled a study performed by Bajait et al.² In diabetic individuals, stringent glycaemic management reduces the incidence and advancement of microalbuminuria. During the decline of renal function, insulin requirements decrease due to the kidney's role in insulin breakdown, which may explain the significant proportion of patients not getting any antidiabetic medication. The most commonly administered phosphate binder is sevelamer, whereas the iron supplement is erythropoietin. In a study by Slatopolsky et al.¹⁸, calcium carbonate emerged as the most favoured phosphate binder among individuals with chronic kidney disease (CKD). Erythropoietin was the predominant iron supplement utilized in a study conducted by Collins.¹⁹

In this study population, drug-related problems (DRPs) were identified in 428 of 203 prescriptions. The prevalence of improper drug interactions was the highest, succeeded by frequency errors and indications without corresponding drugs. This contradicted the study of Zaman Huri and Fun Wee, which indicated that poor awareness of medical conditions was the most prevalent issue, followed by erroneous drug interactions.²⁰

This study revealed that nearly all patients experienced polypharmacy, potentially contributing to a heightened incidence of medication interactions. The demanding

schedules of nurses and patients' noncompliance with medications are two primary variables that lead to an increased incidence of mistakes. Frequently, certain underlying comorbidities or problems exhibit no apparent signs or symptoms. Consequently, those problems remain unaddressed, resulting in an escalation of symptoms without pharmacological intervention. The effects of certain medicines can also obscure the symptoms of existing ailments. The rising prevalence of CKD patients has resulted in diminished individualized care, leading to inaccuracies in dose changes and appropriate drug dosing.

This study indicates that issues related to inadequate patient awareness, adverse drug reactions (ADRs), unsuitable medications, contraindications, and concerns regarding ADRs are few. This signifies that the research population received good patient education, and the delivery of medication services is enhancing. The active involvement of a comprehensive pharmaceutical care team, comprising physicians, pharmacists, nursing personnel, and other paramedical workers, helps address drug-related problems and enhance overall patient care.^{14, 21, 22}

CONCLUSION

Among these patients, polypharmacy is common and the most commonly used drug class is antihypertensives. Drug-related problems such as drug interaction or frequency error is quite common, and demands careful management, clinical pharmacist integrated into IPD care. Pharmacists would be able to play pivotal roles in reinforcing successful pharmaceutical care and collaborative healthcare teams, which are necessary for effective resolution of these challenges.

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