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ASSESSMENT OF DRUG INTERACTION AND ADVERSE DRUG REACTION IN PATIENTS OF CHRONIC KIDNEY DISEASE WITH HEMODIALYSIS

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ABSTRACT

Chronic kidney disease (CKD) is the presence of kidney damage or an estimated glomerular filtration rate of less than 60 mL/min/1.73 m², persisting for 3 months or more. The incidence of chronic kidney disease increases all over the world, It was ranked 27th in the list of causes of total number of worldwide deaths in 1990, but rose to 18th in 2010.Descriptive cross sectional study in Khyber teaching hospital Peshawar conducted to assess medication interactions and adverse drug reactions (ADRs) in chronic kidney disease patients undergoing hemodialysis. According to the prevalence of chronic renal disease by age, the lowest age of patients was 16 and the highest was 86. According to this survey, 46 is the average age. The findings indicate that of the fifty (50) patients with CKD, twenty-eight (56%) are female, and twenty- two (44%) are male. The majority of the patients were from the Peshawar region. The most commonly used drugs in the Nephrology ward were cefoperazone + sulbactam, omeprazole, soda mint, iron poly-maltose complex with folic acid, furosemide, and other drugs were given according to their comorbid condition. The most common lab abnormalities were blood urea, hemoglobin, and creatinine levels, the study shows that in all patients these parameters are not in the normal range. ADRs were not reported in all the cases, Drug interactions were identified, with some cases exhibiting major interactions, underscoring the need for careful drug management. Majority of patients are of older age and female, adverse drug reaction were not reported in that patient but durg interaction were determined so proper care is needed in chronic kidney disease patient during hemodialysis.

INTRODUCTION

Chronic Kidney Disease (CKD) is a long-term and progressive disorder characterized by structural or functional abnormalities of the kidneys that persist for at least three months. The condition is clinically defined when there is evidence of kidney damage or a reduction in the estimated glomerular filtration rate (eGFR) to less than 60 mL/min/1.73 m² for three months or longer, regardless of the underlying cause (Vaidya & Aeddula, 2022). CKD represents a major global health burden due to its high morbidity, mortality, and healthcare costs. It is associated with a progressive loss of kidney function, which leads to the accumulation of metabolic waste products, disturbances in electrolyte balance, anemia, bone-mineral disorders, and eventually, end-stage renal disease (ESRD) where renal replacement therapy such as dialysis becomes necessary (Inker et al., 2014).

CLASSIFICATION OF CHRONIC KIDNEY DISEASE:

The 6 categories of CKD staging include:

G1: GFR 90 mL/min/1.73 m2 and above with urinary abnormalities suggesting kidney disease such as hematuria or proteinuria

G2: GFR 60 to 89 mL/min/1.73 m2 G3a: GFR 45 to 59 mL/min/1.73 m2 G3b: GFR 30 to 44 mL/min/1.73 m2 G4: GFR 15 to 29 mL/min/1.73 m2

G5: GFR less than 15 mL/min/1.73 m2 or ESRD

The 3 levels of albuminuria include ACR:

A1: ACR less than 30 mg/g (<3.4 mg/mmol)
A2: ACR 30 to 299 mg/g (3.4-34 mg/mmol)
A3: ACR greater than 300 mg/g (>34 mg/mmol) (Levey et al., 2002).

CKD is categorized into five stages based on the degree of decline in kidney function. These range from stage G1, where GFR remains normal or high but accompanied by signs of kidney damage, down to stage G5, which indicates severe kidney failure with a GFR less than 15 mL/min/1.73 m², commonly requiring dialysis or kidney transplantation (Levey et al., 2002). Albuminuria staging is also used alongside GFR classification to assess disease severity and prognosis. The increasing prevalence of CKD globally has drawn major attention from public health experts. CKD has risen significantly in international mortality rankings, moving from the 27th leading cause of death in 1990 to the 18th in 2010, highlighting its growing public health implications worldwide (Imtiaz et al., 2018).

Hemodialysis is the primary treatment option for patients with ESRD. It serves as an artificial method of filtering blood to remove excess waste and maintain electrolyte balance. In hemodialysis, the patient's blood is circulated through a dialyzer containing thin hollow fibers, which allow the diffusion of waste products into a dialysis solution. The purified blood is subsequently returned to the patient’s circulation (Baxter & Preston, 2010). Although hemodialysis is life-sustaining, it places patients at risk for various complications due to polypharmacy, comorbid diseases, and altered drug clearance.

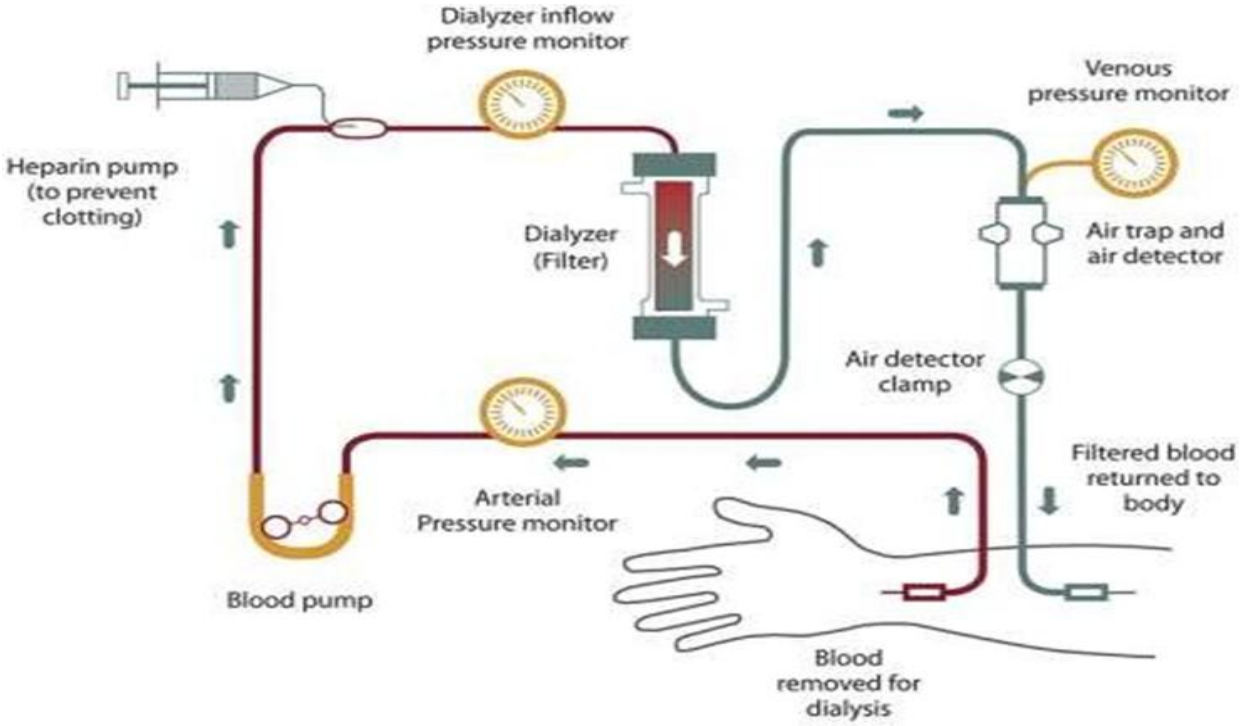

Fig 1 HEMODIALYSIS
During hemodialysis, your blood flows through a filter known as a dialyzer.

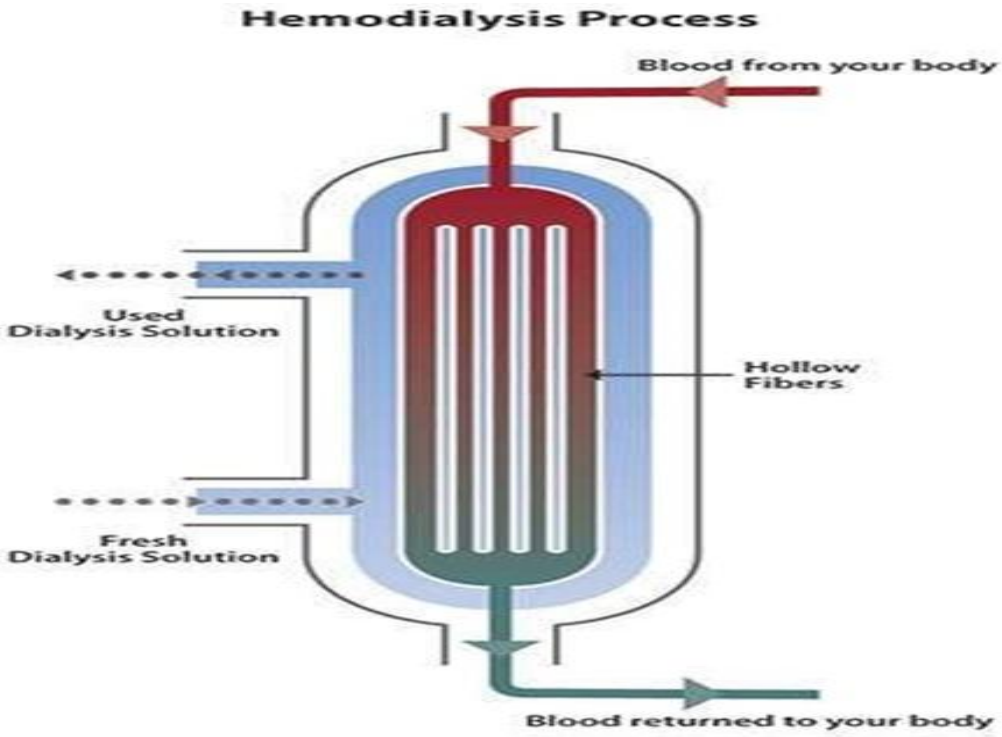

Fig 2 Hemodialysis Process

CKD patients undergoing hemodialysis are often prescribed multiple medications, including antibiotics, antihypertensives, diuretics, phosphate binders, iron supplements, and drugs for gastrointestinal symptoms. Polypharmacy increases the likelihood of adverse drug reactions (ADRs), which are harmful and unintended effects of medications taken at normal therapeutic doses (Baxter & Preston, 2010). ADRs may range from mild symptoms, such as nausea or rashes, to severe and life-threatening reactions requiring hospitalization. Monitoring and reporting ADRs is a major component of pharmacovigilance, aiming to ensure patient safety.

Another important issue in the treatment of CKD patients is the occurrence of drug–drug interactions (DDIs). Drug interaction occurs when the therapeutic effect of one drug is altered by the presence of another drug or substances such as food or herbal medicines (Wang & Cheng, 2020). These interactions can be additive, synergistic, or antagonistic, and their clinical outcomes vary from minor to severe depending on the drugs involved (Greco, 1995). The risk of drug interactions increases significantly as the number of medications prescribed rises. Studies show that patients taking more than ten medications experience a notably higher rate of interactions (Baxter & Preston, 2010). Given that CKD patients frequently use multiple medications, systematic evaluation of potential DDIs is essential.

The current study focuses specifically on CKD patients undergoing hemodialysis at Khyber Teaching Hospital, Peshawar. The objective is to identify the frequency and severity of drug interactions and assess the presence of adverse drug reactions in this population. Understanding these risks is necessary to support healthcare professionals in optimizing drug therapy, reducing medication-related complications, and improving patient outcomes.

LITERATURE REVIEW

Prevalence and Burden of Chronic Kidney Disease

CKD has emerged as a major global public health concern due to its rising prevalence and associated complications. The global prevalence of CKD varies across regions, with estimates indicating that approximately 23.4% of the adult population has some degree of CKD when considering all stages, and around 10.6% are within the advanced stages (Imtiaz et al., 2018). Data from Asian countries demonstrate significant disease burden, especially in densely populated regions such as China and India, which together contribute to nearly 69% of CKD cases in Asia (Baxter & Preston, 2010). Common causes of CKD include diabetic nephropathy, chronic hypertension, infectious disease, and conditions of unknown etiology. Its progression greatly increases risks of cardiovascular events and premature mortality.

Hemodialysis and Management Considerations

Hemodialysis is the most widely used renal replacement therapy for ESRD. The technique allows the removal of electrolytes, toxins, and excess water through diffusion and ultrafiltration. Hemodialysis maintains physiological balance but does not replace endocrine functions of the kidney, such as erythropoietin production. As a result, anemia is common in CKD patients, contributing to fatigue and decreased quality of life. Hemodialysis patients require multiple drug therapies to manage complications, including anemia, metabolic acidosis, mineral bone disorder, hypertension, and infections (Vaidya & Aeddula, 2022).

Adverse Drug Reactions in CKD Patients

CKD patients are particularly susceptible to ADRs due to altered pharmacokinetics and pharmacodynamics. Reduced renal clearance influences drug metabolism and elimination, leading to accumulation of medications or their metabolites at toxic levels (Baxter &

Preston, 2010). ADRs are often classified using the Rawlins and Thompson system into dose-dependent and unpredictable reactions. Patients receiving medications such as diuretics, antibiotics, and mineral supplements frequently experience reactions ranging from gastrointestinal discomfort to hematologic changes. Detection and reporting systems such as spontaneous reporting and institutional monitoring help improve safety measures.

Drug–Drug Interactions in Polypharmacy

Polypharmacy in CKD patients significantly increases the likelihood of drug–drug interactions. These interactions are classified as additive, synergistic, or antagonistic based on how combined drug effects deviate from expected outcomes (Greco, 1995). Clinically significant interactions require careful monitoring, especially when involving nephrotoxic or cardiotoxic agents. Studies indicate that patients taking six or more medications show a higher incidence of major drug interactions (Baxter & Preston, 2010). Interactions may be minor and clinically insignificant, moderate requiring therapy adjustments, or major requiring immediate discontinuation or substitution of drugs.

Clinical Importance of Identifying ADRs and DDIs

Monitoring ADRs and DDIs in CKD patients is crucial to reduce hospitalization, prevent treatment failure, and improve patient well-being. The use of computerized interaction checkers, medication reconciliation, and interdisciplinary pharmaceutical care can significantly reduce risks (Wang & Cheng, 2020). The role of clinical pharmacists is especially important in identifying potential medication risks and providing preventive recommendations.

CLASSIFICATION OF ADVERSE DRUG REACTIONS:-

Rawlins Thompson Classification

(Terminology as standardized by the European Union according to
Reported frequency in clinical trials)

Table 1: Rawlins & Thompson Classification of Adverse Drug Reactions

Type	Dose Dependent	Onset Basis	Examples	Severity Basis	Frequency Basis
Type A	Yes	**Acute:** within 60 minutes	Nausea, vomiting, bronchoconstriction	**Mild:** No hospitalization required	**Very Common:** >10%
Type B	No	**Subacute:** within 1–24 hours	Rashes, serum sickness	**Moderate:** Change in therapy required	**Common:** 1–10%
Type C	Yes (chronic dose-related)	**Latent:** after 2 days or more	Organ toxicity	**Severe:** Prolonged hospitalization required	**Uncommon:** 0.1–1%
Type D	No (delayed reaction)	**Delayed:** occurs after long-term use	Teratogenesis, carcinogenesis	Can be severe	**Rare:** 0.01–0.1%

Type E	Withdrawal-related	**End of use:** after stopping medication	Withdrawal or rebound effects	Variable severity	**Very Rare:** <0.1%
Type F	Therapy failure (unexpected)	**Variable timing**	Drug resistance or failure of treatment	Can require change of therapy	Not frequency classified

CLASSIFICATION :

ADDITIVE: The result is what you expect when you add together the effect of each drug taken independently,

SYNERGISTIC: Combining the drugs leads to a larger effect than expected).

ANTAGONISTIC: Combining the drugs leads to a smaller effect than expected (Greco, 1995)

The more drugs a patient takes the greater the likelihood that an adverse reaction will occur. One hospital study found that the rate was 7% in those taking 6 to 10 drugs but 40% in those taking 16 to 20 drugs, which represents a disproportionate increase.[1]A possible explanation is that the drugs were interacting (Baxter & Preston, 2010).

Table 2: Drug Interaction Severity Classification

Significant Rate (SR)	Severity	Example	Onset	Action Required	Documentation
SR 1	**Contraindicated** – Shows negative / harmful effect	*Ketoconazole + Simvastatin*	**Rapid:** Within 24 hours	**Immediate action is required**	**Established:** Proven to occur in most cases
SR 2	**Major** – Life threatening	*Gentamycin + Furosemide*	**Delayed:** Days to weeks	**Monitor closely; modify therapy if needed**	**Probable:** Likely to occur but not clinically proven
SR 3	**Moderate** – Change of therapy required	*Acetaminophen + Carbamazepine*	**Variable onset**	**Therapy adjustment needed**	**Suspected:** May occur but requires more evidence
SR 4	**Minor** – Does not significantly affect therapeutic outcomes	*Aspirin + Hydrocortisone*	**Variable**	**No change in therapy needed**	**Possible:** Limited reports, data insufficient
SR 5	**No Interaction / Unlikely**	—	**None**	**No action required**	**Unlikely:** Very doubtful, no evidence of clinical significance

MANAGEMENT OF DRUG INTERACTION:

According to HANSTEN and HORNS drug interaction analysis and management are classified into five classes.

Table 3: Drug Interaction Analysis and Management Classification (Hansten & Horn)

Class	Action	Description	Severity	Example
Class 1 Interaction	**Avoid Combination**	Combination is **life-threatening** and must not be used	**Contraindicated**	*Simvastatin + Erythromycin*
Class 2 Interaction	**Usually Avoid Combination**	Combination should be used **only in special conditions** depending on clinical outcomes	**Moderate**	*Aspirin + Warfarin*
Class 3 Interaction	**Minimize the Risk**	Therapy modification or **close monitoring** is required	**Moderate**	*Paracetamol + Isoniazid*
Class 4 Interaction	**No Action Needed**	Interaction is **clinically minimal** and does not affect outcomes	**Minor**	*Lithium + Ethacrynic Acid*
Class 5 Interaction	**No Interaction**	Evidence indicates **no significant interaction**	**None (NIL)**	*Theophylline + Azithromycin*

Table 4 ADR OF DRUGS USED IN NEPHROLOGY WARD

Adverse Drug Reactions of Drugs Used in Nephrology Ward

S.No.	Drug(s)	Reported Adverse Drug Reactions (ADRs)
1	Furosemide	Chest pain, chills, headache, painful or difficult urination, shortness of breath, sore throat, unusual bleeding or bruising
2	Iron hydroxide polymaltose complex + Folic acid	Backache, blood in urine, bluish discoloration of lips/nails/skin, blurred vision, chest pain, chills, confusion, fainting, fast weak pulse, nausea, nervousness
3	Cefoperazone + Sulbactam	Nausea, diarrhea, vomiting, increased liver enzymes, decreased hemoglobin/hematocrit, thrombocytopenia, temporary rise in BUN/Creatinine, skin rashes, seizures
4	Ceftriaxone	Black tarry stools, chest pain, chills, cough, fever, painful urination, shortness of breath, sore throat, swollen glands, unusual bleeding, fatigue, diarrhea, abdominal cramps
5	Meropenem	Constipation, injection site swelling/redness, body pain, cold extremities, cold sweats, congestion, indigestion, runny nose, sneezing
6	Omeprazole	Body aches, diarrhea, difficulty breathing, dizziness, ear congestion, heartburn, loss of voice, muscle pain
7	Allopurinol	Joint pain/stiffness, swelling, skin rashes including flat red lesions
8	Folic Acid	Fever, general weakness, skin redness, shortness of breath, rash/itching, chest tightness, wheezing
9	Metolazone	Bleeding gums, blistering, bloating, hematuria, blurred vision,

		bone pain, chest pain, chills, clay-colored stool, cold sweats, coma, confusion, constipation, convulsions
10	Alfacalcidol	Nausea, headache, constipation, rash, abdominal pain, increased urinary calcium, excessive thirst, itching, weakness
11	Drotaverine	Nausea, headache, diarrhea, dizziness, dermatitis, dry mouth, hypertension
12	Iron Sucrose	Bloating, blurred vision, chest pain, confusion, dizziness, headache, nervousness, pounding heartbeat, rapid weight gain
13	Labetalol	Nausea, acid reflux, belching, altered taste, headache, heartburn, indigestion, weakness, nasal congestion
14	RHE (Recombinant Human Erythropoietin)	Hypertension, arthralgia, injection site pain, headache, nausea, vomiting, cough, fever
15	Sucralfate	Constipation, backache, bloating, diarrhea, dizziness, gas formation, headache, indigestion, drowsiness
16	Alphacalcidol	Nausea, headache, constipation, rash, abdominal pain, increased urine calcium, thirst, itching, weakness
17	Calcium Gluconate	Allergic reactions (rash, hives, facial swelling), irregular heartbeat
18	Diclofenac Sodium	Acid reflux, belching, bleeding gums, hematuria, burning urination, chest pain, chills, cough
19	Clopidogrel	Skin bleeding, deep bruising, itching, pain, redness or swelling
20	Fluconazole	Belching, altered taste, heartburn, indigestion, stomach discomfort
21	Gut Care Sachet (Probiotic)	Allergic reactions, digestive discomfort, possible drug interactions
22	Sodamint	Abdominal pain, bloating, headache, swollen feet, increased thirst, weakness, frequent urination, heartburn, loss of appetite, slow breathing

AIMS AND OBJECTIVES AIM:

Aims are to assess medication interactions and adverse drug reactions (ADRs) in chronic kidney disease patients undergoing hemodialysis.

OBJECTIVE:

1. Identify and divide possible drug-drug interactions (DDIs) in chronic kidney disease patients undergoing hemodialysis.

RESEARCH METHODOLOGY

Study Design

This study was conducted as a descriptive cross-sectional study. Cross-sectional studies are observational in nature and are used to analyze data collected from a specific population at a single point in time. Such studies are useful in determining the prevalence of particular health conditions and in describing population characteristics relevant to the research objectives.

Study Setting

The research was carried out at Khyber Teaching Hospital (KTH) in Peshawar. The data required for the study was specifically collected from the Nephrology Ward of the hospital, where patients undergoing treatment for chronic kidney disease and hemodialysis were admitted.

Study Participants

The study involved patients admitted to the Nephrology Ward of Khyber Teaching Hospital. Participants included both male and female patients of varying ages and backgrounds. Patients of different socio-demographic characteristics were included to obtain a representative dataset.

Inclusion Criteria

Patients were included in the study if they were diagnosed with chronic kidney disease and undergoing hemodialysis. Only those patients whose medical records were complete were considered. Additionally, the data was collected from patients who were conscious and accompanied by an attendant able to provide reliable information. Patients from all age groups were eligible to participate.

Exclusion Criteria

Patients who had expired during the study period, if any, were excluded from the analysis.

Sampling Technique and Sample Size

A non-probability convenient sampling technique was used for participant selection. This method was chosen based on accessibility and availability of patients during the study period. Although the initial planned sample size was 40, the final sample size was increased to 50 based on patient availability during the data collection period from 13th May 2024 to 7th June 2024.

Study Approval

Approval to conduct the study was granted by the competent authorities under letter No. 5045/KTH/HRD dated 14-0-2024. The research was carried out under the supervision of the pharmacy manager and the ward in-charge to ensure compliance with ethical and institutional guidelines.

Data Collection

Data was collected using two primary sources: direct questioning of the patient's attendant and review of the patient chart available in the ward. The combination of verbal responses and documented medical records ensured the accuracy of patient information.

Questionnaire

A structured questionnaire was used to obtain data regarding adverse drug reactions and drug interactions. The questionnaire included questions regarding unexpected symptoms following medication intake, use of additional prescribed or over-the-counter drugs, adherence to dosage and timing, previous history of adverse drug responses, dietary or substance-related interactions, symptom onset timing, and whether symptoms improved or worsened after continuing or stopping medication. Further questions also addressed respiratory issues, allergic symptoms, and gastrointestinal disturbances possibly linked to medication use.

Patient Chart Review

The patient charts were examined for:

Patient identification and demographic information (name, gender, age, bed number, date of admission)

Chief complaints and presenting symptoms

Complete list of prescribed medications

Data Analysis

The collected data was entered into Microsoft Excel and subsequently analyzed using the Statistical Package for the Social Sciences (SPSS). Statistical analysis facilitated the systematic evaluation of the data and helped derive meaningful findings related to adverse drug reactions and drug interactions.

Result and Discussion

After data collection, the acquired data was transferred to an Excel sheet that had been specifically constructed. Data from Excel was then imported to the SPSS (Statistical Package for the Social Sciences).

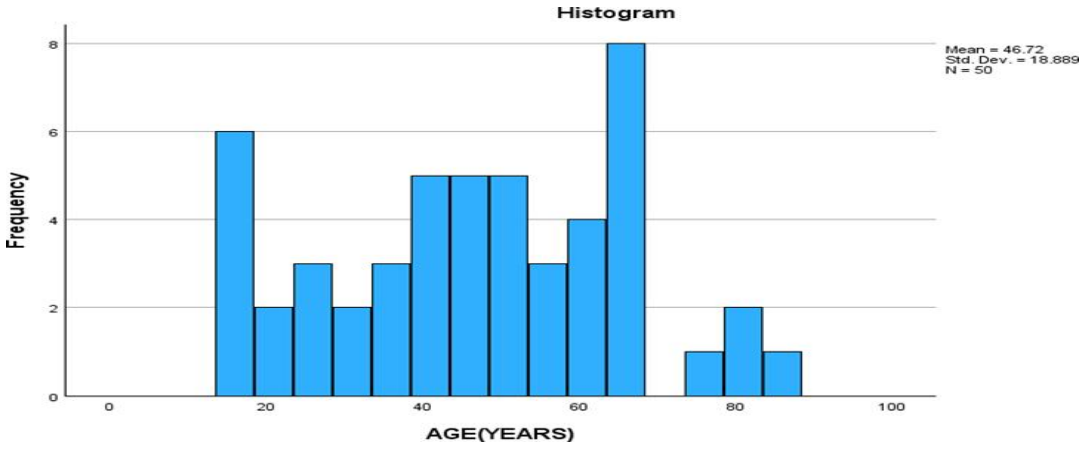

Fig 3 Age-wise prevalence

According to the age-wise prevalence, the majority of patients are above 50.According to the prevalence of chronic renal disease by age, the lowest age of patients was 16 and the highest was 86. According to this survey, 46 is the average age.

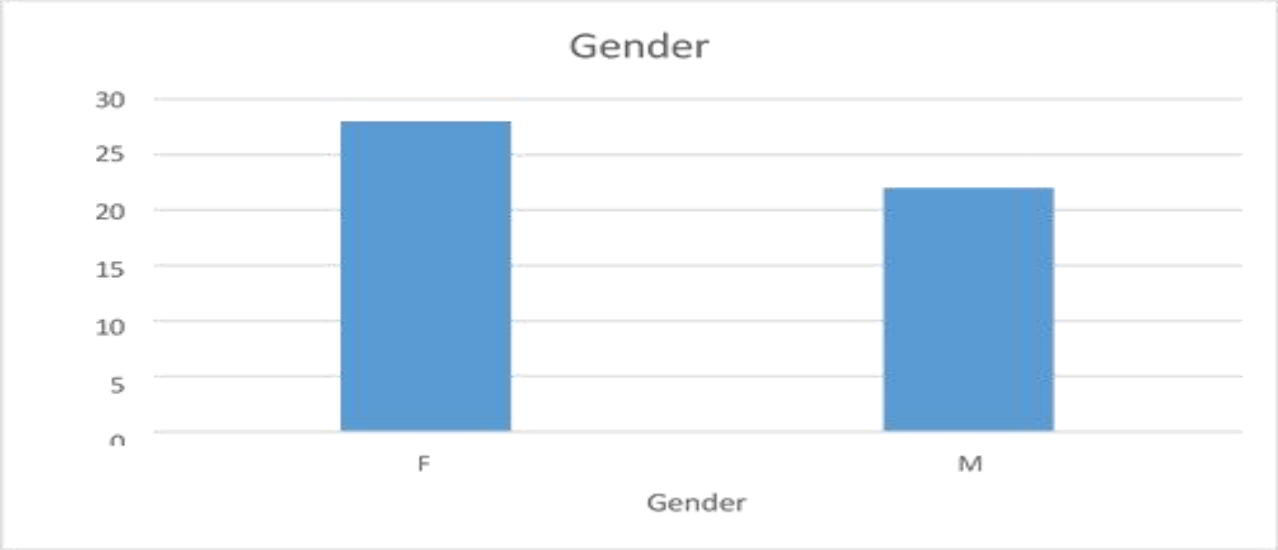

Fig 4 Gender-wise prevalence

The findings indicate that of the fifty (50) patients with chronic renal disease, twenty-eight (56%) are female, and twenty-two (44%), respectively, are male.

The previous studies show that prevalence is higher in females than males but the studies also show that there is geographic variability. In 2007 the US Renal Data System (USRDS) annual data report, the prevalence of chronic kidney disease was higher in females than males in the year from 2007-2012. The percentage was 15.1% in females than males 12.1%.

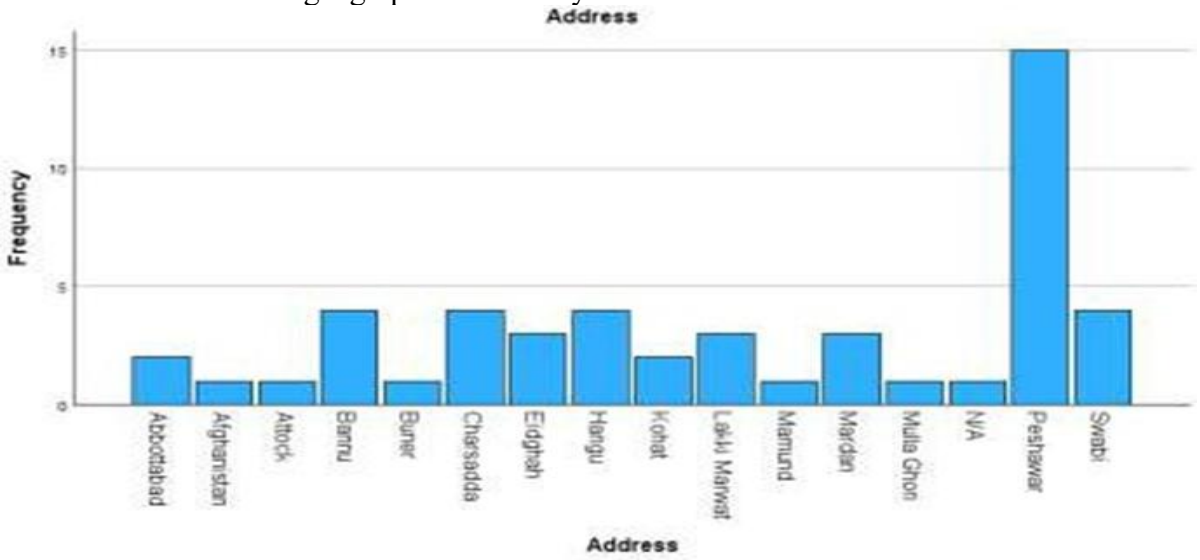

Fig 5 Distribution of patients location-wise

The majority of the patients (15) were from the Peshawar region, although some came from farther away places including Afghanistan, Mardan, Swabi, and Bannu. Due to the fact that the hospital where the cases were gathered is located in Peshawar, there were more patients from that city.

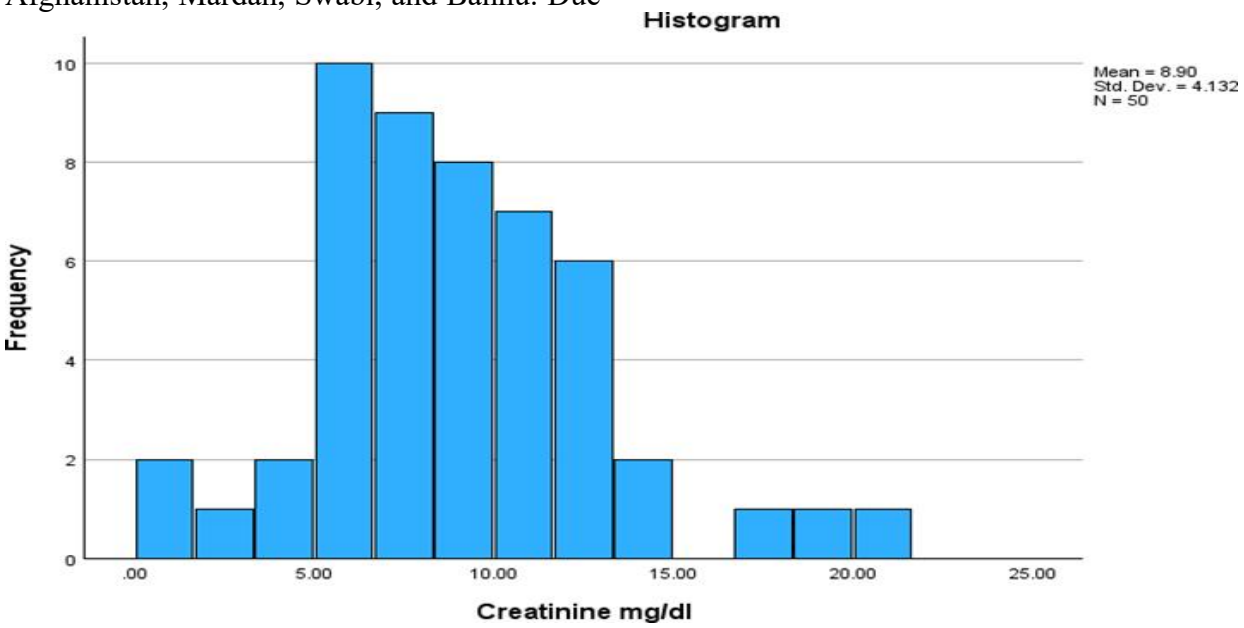

Fig 6 Lab Value Cr

Although creatinine normally ranges between 0.64 to 1.2 mg/dl, the data we gathered indicates that all patients had creatinine levels that were greater than normal. This is due to the fact that creatinine is mostly eliminated from the body by GFR, and individuals with chronic renal disease have poor glomerular filtration rates.

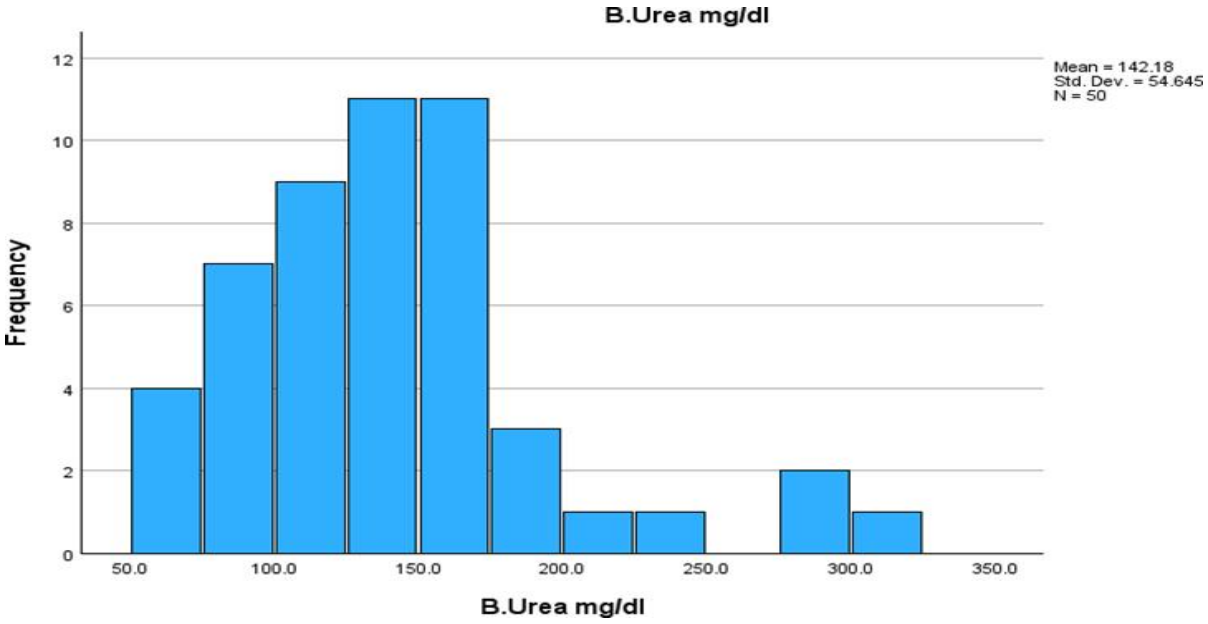

Fig 7 Lab values B.UREA

Normal blood urea levels range between 10 and 50 mg/dl. The data gathered for this study indicates that patients have high blood urea levels, which are caused by low glomerular filtration rate, which is low due to progressive nephron loss and decreased blood urea clearance, which leads to high blood urea accumulation.

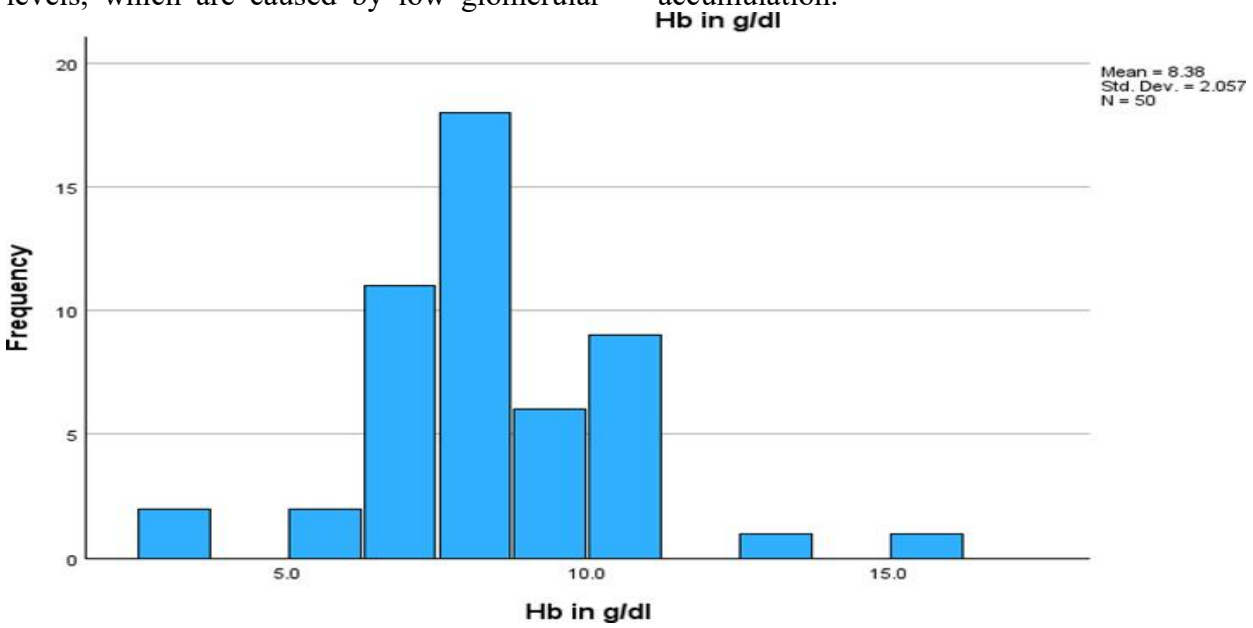

Fig 8 lab value Hb

Hemoglobin levels in the body typically fluctuate between 11.5-17.5however, the results gathered for this study indicate that in chronic renal illness, hemoglobin levels are lower, sometimes too low. This is because chronic renal disease damages the kidneys, which lowers the synthesis of erythropoietin. A further reason is that chronic kidney illness leads to chronic inflammation, which raises the levels of inflammatory cytokines and suppresses erythropoiesis.

ADR and DDIs Statistics

Statistics

		ADR	DIs	Minor	Moderate	Major	Monitoring of Drug Interaction	Major Interaction
N	Valid	50	50	50	50	50	50	50
	Missing	0	0	0	0	0	0	0

Adverse Drug Reactions Frequencies

ADR

	N	%
Not Reported	50	100.0%

Adverse medication responses were not documented in the hospital for this study, and most of the patient attendants who answered the questions had neither knowledge of nor experience with adverse drug reactions after medical treatments.

Drug-drug interactions Frequencies

Dis

	N	%
Yes	50	100.0%

Minor Drug-drug interaction

Minor

	N	%
0	33	66.0%
1	12	24.0%
2	4	8.0%
3	1	2.0%

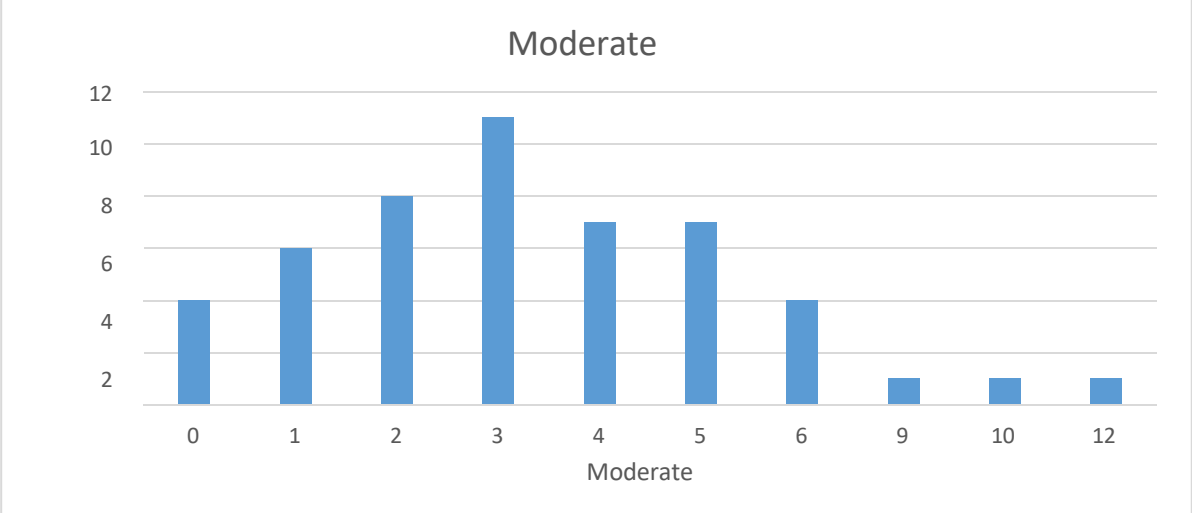

Fig 9 Moderate drug-drug interactions

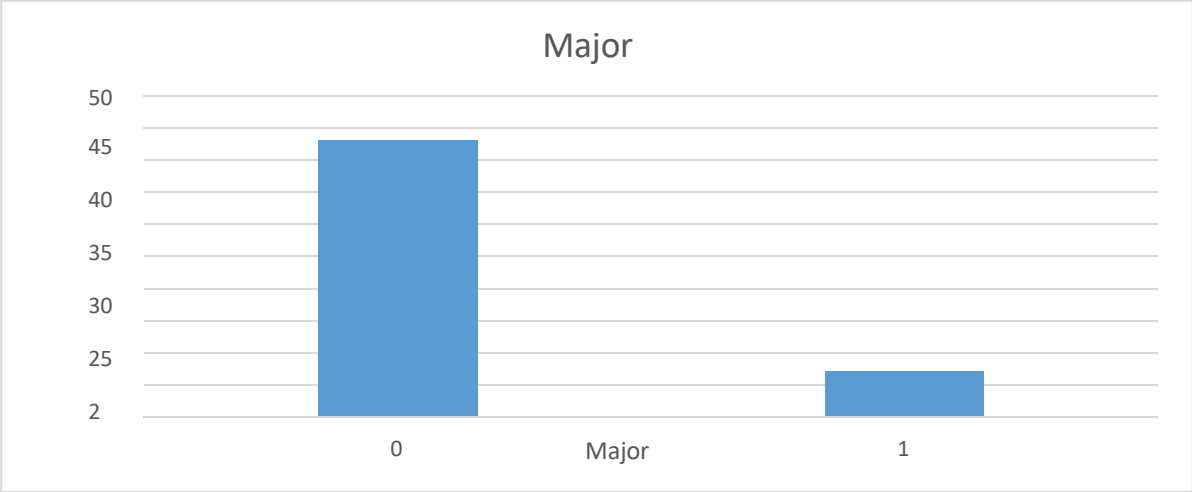

Fig 10 Major drug-drug interactions

In this study, the website drug.com is used to find the potential drug-drug interactions used by the patients there are minor (minimal effects that are typically tolerable), moderate (potential for significant interaction but not reaching the criteria for major severity), and major (potential for serious interaction that typically demands medical intervention) drug interactions table and the figure is plotted which show the results.

The study shows that in 50 cases, 33 cases (66%) have no minor interactions, 12 cases (24%) show 1 minor interaction, 4 cases (8%) show 2 minor interactions and only 1 case (2%) shows 3 minor interactions.

The study shows that in 50 cases, 4 cases (8%) have no moderate interactions, 6 cases(12%) show 1 moderate interaction, 8 cases (16%) show 2 moderate interactions,

11 cases (22%) show 3 moderate interactions,7 cases (14%) show 4 moderate interactions,7 cases (14%) show 5 moderate interactions, 4 cases (8%) show 6 moderate interactions, 1 cases (2%) show 9,10,12 moderate interactions.

The study shows that in 50 cases, 43 cases (86%) have no major interactions, and 7 cases (14%) show 1 major interaction.

List of Major drug-drug interactions

Major Interaction

	N	%
alfacalcidol/sucralfate	2	4.0%
ceftriaxone/calcium gluconate	1	2.0%
divalproex sodium/meropenem	1	2.0%
nil	43	86.0%
ondansetron/domperidone	1	2.0%
ondansetron/moxifloxacin	1	2.0%
orphenadrinecitrate/clopidogrel	1	2.0%

Monitoring of drug interaction

Monitoring of Drug Interaction

	N	%
Initial Assessment was done and Drug.com is used to monitor drug interaction.	50	100.0%

In the monitoring of potential drug-drug interactions initial assessment was done they assess the mechanism of interaction, patient variables such as age, kidney, liver function comorbid conditions, and the duration of interactions whether immediate, delayed, or onset.

OVERALL DISCUSSION:-

This present work focuses on the identification of adverse drug reactions (ADRs) and drug interactions (DIs) In the Nephrology ward, at Khyber Teaching Hospital (KTH), Peshawar.

Females constitute the majority of patients (56%) and male patients (44%). The most

affected age group was above the age of 50 due to comorbid conditions.

The most commonly used drugs in the Nephrology ward were cefoperazone + sulbactam, omeprazole, soda mint, iron poly-maltose complex with folic acid, furosemide, and other drugs were given according to their comorbid condition.

The most common lab abnormalities were blood urea, hemoglobin, and creatinine levels, the study shows that in all patients these parameters are not in the normal range.

ADRs were not reported in all the cases, Drug interactions were identified, with some cases exhibiting major interactions, underscoring the need for careful drug management.

Conclusion

This study assessed the prevalence of drug interactions and adverse drug reactions (ADRs) in patients with chronic kidney disease (CKD) undergoing hemodialysis at the Nephrology Ward of Khyber Teaching Hospital, Peshawar. CKD remains a progressive and long-term condition that requires lifelong management, and hemodialysis patients are particularly vulnerable to drug-related problems due to altered pharmacokinetics, comorbid illnesses, and the frequent use of multiple medications. In this study population, the average age of patients was 46 years, with a higher prevalence observed in females as compared to males. This aligns with global epidemiological trends indicating increased susceptibility among older adults and women.

The findings revealed that all patients exhibited abnormal biochemical parameters, particularly elevated creatinine and blood urea levels, as well as reduced hemoglobin levels. These laboratory abnormalities reflect impaired kidney function, reduced clearance of metabolic waste, and diminished erythropoietin production—typical complications in CKD. Patients were commonly prescribed antibiotics such as cefoperazone with sulbactam and ceftriaxone, diuretics such as furosemide, gastrointestinal protectants, iron supplements, antihypertensives, and drugs for mineral and bone metabolism.

Although adverse drug reactions were not widely reported, drug–drug interactions (DDIs) were frequently identified. Most interactions fell into the moderate category, requiring adjustments or monitoring, while a smaller number were categorized as major, indicating a potential for serious clinical consequences. Moderate interactions were found in various combinations related to renal clearance, electrolyte balance, and cardiovascular regulation. Major interactions, although less frequent, highlight the importance of vigilance in pharmacotherapy, especially when nephrotoxic or cardiotoxic drugs are administered. Minor interactions were also present but did not significantly influence therapeutic outcomes.

The absence of severe ADRs in documentation may also indicate underreporting due to limited pharmacovigilance practices or lack of patient awareness. This highlights the need for intensified monitoring systems, patient education, and the active involvement of clinical pharmacists in multidisciplinary care teams. Given that drug interactions can be minimized through accurate medication history assessment, dose adjustment based on renal function, and regular therapeutic monitoring, healthcare providers play a critical role in ensuring medication safety.

Overall, this study emphasizes the importance of systematic evaluation and monitoring of drug therapy in CKD patients receiving hemodialysis. Strengthening pharmacovigilance practices, improving prescribing awareness, and incorporating regular drug interaction screening tools can significantly reduce drug-related complications and improve clinical outcomes in this vulnerable population.

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