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Therapy Profile and Drug Use Analysis of Chronic Kidney Disease Patients Hospitalized at Dr. H. M. Ansari Saleh Hospital

(Profil Terapi dan Analisis Penggunaan Obat Pasien Chronic Kidney Disease Rawat Inap Rumah Sakit dr. H. M. Ansari Saleh)

Okta Muthia Sari*, Aditya Maulana Perdana Putra, Putri Nur Azizah, Sofia

Program Studi Farmasi, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Lambung Mangkurat, Banjarbaru, Indonesia.

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Corresponding Author:
Okta Muthia Sari
Program Studi Farmasi
Fakultas MIPA
Universitas Lambung Mangkurat
Banjarbaru
Indonesia
email:
okta.sari@ulm.ac.id

ABSTRACT

Background: Therapy in chronic kidney disease aims to slow down the prognosis of the disease. **Objectives:** Describe the types of classes and names of most drugs in treating chronic kidney disease patients based on the stage of the disease. As well as analysing the use of renal risk drugs in patients with chronic kidney disease. **Methods:** This descriptive research will be carried out in May-June 2023. The population of this study was the entire medical record of inpatient chronic kidney disease patients at Ansari Saleh Hospital. Data analysis was performed uni variat for the study of patient characteristics and therapy profiles, while the analysis of the use of renal risk medications refers to the 2019 renal handbook. **Results:** A total of 51 medical records were analysed. The top five drug classes based on stages 4 and 5 include diuretics, cephalosporin antibiotics, vitamins, trace elements, angiotensin II receptor blockers, and insulin. The top five drugs received by patients based on disease stages 4 and 5 consist of furosemide, ceftriaxone, aminefron®, candesartan, and insulin aspart. Renal risk drugs found in studies include drugs that need dose adjustment, are lisinopril, ramipril, cefixime, cefotaxime, meropenem, levofloxacin, ciprofloxacin, bisoprolol, diltiazem, and simvastatin. At the same time, renal-risk drugs that need to be avoided are hydrochlorothiazide and spironolactone. **Conclusions:** Furosemide diuretics are the most widely used therapy in stages 4 and 5. Hospitalised chronic kidney disease patients receive some renal risk drugs that, in the literature, need dose adjustment, and some need to be avoided.

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INTRODUCTION

Chronic kidney disease (CKD) is characterized as kidney structural or function problems that last more than three months and have health consequences. Chronic kidney disease is characterised by gradually losing kidney function over time. Chronic kidney disease has become a significant health problem worldwide, resulting in death in (Santos-Díaz et al., 2020). Based on data from the World Health Organization, every year, it is estimated that around 5-10 million people die from kidney disease (Luyckx, Tonelli, and Stanifer, 2018). In addition, chronic kidney disease is projected to be the world's fifth leading cause of death by 2040 (Luyckx et al., 2021).

Therapy in chronic kidney disease aims to slow down the prognosis of the disease. The therapies range from antihypertensives, antidiabetics, dyslipidemia drugs, antiplatelets, and anaemia drugs to hyperkalemia drugs (DiPiro, 2020). The selection of treatment for chronic kidney disease patients needs to pay attention to the stage of the disease (Vassalotti et al., 2016). In the use of drugs in chronic kidney disease, there is a need for dose adjustment or avoidance due to glomerular filtration rate values that decrease from the average. Research by Deskur-Śmielecka et al. in 2019 showed that 40% of patients with chronic kidney disease stage 3 And nearly 60% of patients with stage 4 and 5 chronic kidney disease are taking at least one medication that should be avoided or recommended dose adjustment. The most commonly used medications that should be avoided in chronic kidney disease patients are diuretics (spironolactone, hydrochlorothiazide, and amiloride), NSAIDs, and metformin. The most often used but recommended dose adjustments are piracetam, digoxin, gliclazide, and ranitidine. These drugs are included in renal risk drugs or drugs at risk for kidney disorders (Deskur-Śmielecka et al., 2019).

Research on the therapeutic profile of chronic kidney disease patients has been carried out in various countries, including Indonesia, and the results are mixed. The therapy given depends on the characteristics of the patient himself, where the study results show differences in the class of drugs and the types of drugs used in research. Widianti's research (2021) on the description of drug use in patients with chronic renal failure at the Muhammadiyah Gamping General Hospital states that the 3 largest drugs used by patients are cardiovascular and hematopoietic system drugs, gastrointestinal and hepatobiliary systems, and vitamins and minerals (Widianti & Woro, 2021). These results also align with research conducted by Tuloli (2019), which states the 3 largest drug profiles are antihypertensive, supplements and gastric drugs. The therapy obtained by patients with chronic renal failure varies greatly and depends on the conditions and comorbid diseases each patient suffers (Tuloli, Madania, Mustapa, & Tuli, 2019). However, there is no data on the profile of drug use in patients with renal failure in Kalimantan, especially in Dr. Moh. Ansari Saleh Hospital. In addition, treatment profiles based on CKD stage are still very limited.

Based on Ministry of Health of the Republic of Indonesia data in 2018, the prevalence of chronic kidney disease patients in South Kalimantan was 24.34% and included in the top ten in Indonesia. The majority of chronic kidney disease patients in South Kalimantan is greater than the national average of 19.33% (Ministry of Health of the Republic of Indonesia, 2019). One of the hospitals in South Kalimantan that serves chronic kidney disease patients is Ansari Saleh Hospital. Ansari Saleh Hospital is a type B hospital and is a reference in South Kalimantan. Therefore, it is necessary to conduct therapeutic profile research and analysis of the use of renal risk drugs in chronic kidney disease patients at Ansari Saleh Hospital. The goal is to describe the types of classes and names of drugs that are most common in treating hospitalised chronic kidney disease patients by stage of the disease. As well as analysing the use of renal risk drugs in patients with chronic kidney diseases.

MATERIAL AND METHODS

Research Design

This research is analytical research with a retrospective cross-sectional design. The research was conducted at Ansari Saleh Hospital Banjarmasin from May to June 2023. The Medical Research Ethics Commission of Lambung Mangkurat University has granted ethical permission with Ethical Clearance letter number 061/KEPK-FK ULM/EC/IV/2023.

Population and Research Instruments

The population in this study is all electronic medical records of inpatient chronic kidney disease patients from January-December 2022 and January-March 2023 at Ansari Saleh Hospital Banjarmasin. The sample in this study is a population that meets the inclusion criteria. The sampling technique in this study is saturated sampling. Inclusion criteria include medical records of patients aged ≥ 18 years diagnosed with chronic kidney disease (ICD-10 N18 Code) who received therapy. Exclusion criteria are patients with incomplete medical records with no medical record number, age, gender, comorbid, disease stage or therapy regimen. Data was collected from secondary sources, namely electronic medical records of inpatient chronic kidney disease patients at Ansari Saleh Hospital Banjarmasin. The instrument used in this study was in the form of an observation sheet. The observation sheet consists of patient characteristics (age, sex, comorbid, stage of disease) and data on the therapy regimen (main treatment and supporting treatment/comorbid).

Data Analysis

Univariate analysis was used to examine patient characteristics and treatment profiles. Study of patient characteristics (age, sex, comorbidities, stage of disease) was presented based on the number of medications used. The formula (frequency/total number of patients) multiplied by 100% was used to calculate the percentage of patient characteristics (age, sex, comorbidities, disease stage, and number of drugs used). Therapeutic profiles are presented in terms of drug class and drug name, with percentages

of patients taking drugs by disease stage. The BNF (British National Formulary) 2022 and MIMS (Monthly Index of Medical Specialities) Online are used as references for the classification of drugs in the study. The percentage of drugs used by calculating the formula (frequency/total patients) multiplied by 100%. The 2019 Renal Drug Handbook was used to study the use of renal risk drugs by disease stage. The operational definition of renal risk drugs is drugs that should be avoided or require dose adjustment in patients with impaired renal function (Deskur-Śmielecka et al., 2019).

RESULTS AND DISCUSSION

A total of 51 patients' medical records were analysed in the study. The results showed that most women and the age group over 60 years, similar to previous studies (Nori, Srikartika, and Intannia, 2015). Chronic kidney disease patients are primarily elderly (> 60 years), caused by the increased prevalence of chronic kidney disease risk factors such as diabetes, hypertension, and cardiovascular disease (Mallappallil, Friedman, Delano, Mcfarlane, and Salifu, 2014). After age 40, kidney function decreases by 8-9 ml/minute every decade. This decrease results from normal biological ageing and comorbid processes such as diabetes and hypertension (Deskur-Śmielecka et al., 2019). Further research is needed related to the use of drugs in elderly patients with chronic kidney diseases.

Table 1. Characteristics of Chronic Kidney Diseases Patients

Characteristics		Frequency (%)
Total		51 (100%)
Age	18-59 year	24 (47.1%)
	≥60 year	27 (52.9%)
Sex	Man	25 (49%)
	Woman	26 (51%)
Cormobid	2-4	24 (47.1%)
	>4	27 (52.9%)
Stage CKD	2-3	3 (5.9%)
	4-5	48 (94.1%)
Number of drugs used	3-9	20 (39.2%)
	>9	31 (60.8%)

Most comorbid chronic kidney disease patients are more than 4 per patient. This study's four most common comorbidities were anaemia, cardiovascular heart disease, hypertension, and hyperkalemia. Anaemia in chronic kidney diseases is caused by decreased synthesis of erythropoietin (EPO) and iron deficiency (Guedes et al., 2020). For those who have CKD, because the heart receives less oxygen than normal and works harder to pump enough red blood cells to organs and tissues, severe anemia can enlarge the risk of developing heart problems. There may also be an increased risk of stroke complications in people with CKD and anemia (Babitt & Lin, 2012). Cardiovascular heart disease is increased in patients with chronic kidney disease due to left ventricular hypertrophy with diastolic and systolic dysfunction, valvular disease, and arterial calcification. This pathology can manifest as atrial

and ventricular dysrhythmias, heart failure, and sudden death (Bello et al., 2017). Hypertension in chronic kidney diseases is caused by sodium retention, hypervolemia, sympathetic nerve overactivity, and endothelial dysfunction (Hebert and Ibrahim, 2022). Multiple pathways are associated with the initiation of hypertension: increased sympathetic tone, decreased eGFR, upregulation of the renin-angiotensin-aldosterone system (RAAS), increased salt sensitivity, increased arterial stiffness, and endothelial dysfunction. Several factors, including increased oxidative metabolism and resulting relative renal hypoxia, may promote the development of BP and CKD (Pugh, Gallacher, & Dhaun, 2019). Hypercalcaemia associated with CKD is generally not severe, and patients may be unaware of the clinical signs. Glomerular filtration rate (GFR) may lead to loss of appetite, polyuria/dips, myasthenia gravis, and constipation. Hypercalcemia can further contribute to urolithiasis, especially when combined with hyperphosphatemia, which can lead to soft tissue calcification (Broek, 2022). Pakingki et al.'s research showed similar results where most chronic kidney disease patients had three comorbidities per patient with most diseases, including hypertension, diabetes mellitus, dyspepsia and hyperkalemia (Juanita Pakingki, Mongi, Maarisit, and Z S Karundeng, n.d.).

Table 2. Top Ten Comorbidities in Patients with Chronic Kidney Diseases

Cormobid	Frequency (%) N=51
Anemia	22 (43.14)
Cardiovascular Heart Disease	22 (43.14)
Hypertension	18 (35.29)
Hyperkalemia	15 (29.41)
Infection	11 (21.57)
Diabetes mellitus	10 (19.61)
Hypoalbumin	7 (13.73)
Hyperuricemia	6 (11.76)
Metabolic acidosis	4 (7.84)
Uremic Syndrome	3 (5.88)

The majority of drugs per patient during hospitalisation were more than nine drugs, which indicated polypharmacy. Polypharmacy has been defined as the use of 5 or more medications for one patient at a time. However, given chronic kidney disease's complex nature and comorbidity, some say using more than nine drugs simultaneously is considered polypharmacy. Inappropriate polypharmacy can cause significant morbidity and mortality (Chakraborty et al., 2016). In this study, 94.1% of chronic kidney disease patients were at stages 4 and 5. Where the stage of chronic kidney disease contributes to the selection of patient therapy (Vassalotti et al., 2016), several studies that have been conducted have obtained similar results (Andriani, Rahmawati, and Andayani, 2021; Mohd Shariff, Shah, and Kamaludin, 2017).

The top five drug classes based on stages 4 and 5 include diuretics, cephalosporin antibiotics, vitamins and trace elements, angiotensin II receptor blockers and insulin. Vitamins and trace elements, followed

by diuretics, are the most frequently prescribed drugs. These results differ from a study conducted by Chakraborty et al., where diuretics were more often prescribed in patients with chronic kidney diseases (Chakraborty et al., 2016). As well as in other studies, the drugs most often prescribed in patients with chronic kidney disease are calcium channel blockers (Juanita Pakingki et al., n.d.; Tuloli, Madania, Mustapa, and Tuli, 2019).

The list of the five most common drugs chronic kidney disease patients receive during hospitalisation based on disease stages 4 and 5 consists of furosemide, ceftriaxone, aminephron®, candesartan and insulin aspart. These results align with previous studies by Chakraborty et al., where furosemide was the most commonly accepted drug in patients with chronic kidney disease (Chakraborty et al., 2016).

Table 3. Chronic Kidney Diseases Patient Therapy Profile Based on Disease Stage

Drug Class	Medicine name	Stage 2 - 3	Stage 4 - 5	Frequency (%) N=51
ACE *Inhibitor*	Lisinopril	1	1	3 (5.88)
	Ramipril	0	1	
Angiotensin II Receptor Blockers	Candesartan	1	12	13 (25.49)
Macrolide Antibiotics	Azithromycin	0	4	4 (7.84)
Aminoglycoside antibiotics	Gentamicin	1	0	1 (1.96)
Cephalosporin Antibiotics	Cefixime	0	1	26 (50.98)
	Cefotaxime	1	5	
	Ceftriaxone	0	20	
Carbapenem Antibiotics	Meropenem	1	2	3 (5.88)
Nitroimidazole antibiotics	Metronidazole	1	2	3 (5.88)
Quinolone Antibiotics	Levofloxacin	3	3	7 (13.73)
	Ciprofloxacin	0	1	
Anti-platelet	Aspirin	0	1	3 (5.88)
	Clopidogrel	1	1	
Beta *blocker*	Bisoprolol	0	2	2 (3.92)
Calcium Channel Blockers	Amlodipine	1	6	
	Diltiazem	0	5	13 (25.49)
	Nicardipine HCl	0	1	
Cation Exchange Compound	Calcium Polystyrene Sulfate	0	10	10 (19.61)
Centrally Acting Alpha Agonist	Clonidine	0	2	2 (3.92)
Diuretic	Furosemide	0	31	
	Hydrochlorothiazide	0	1	33 (37.25)
	Spironolactone	0	1	
Electrolytes and Minerals	Potassium Chloride	0	6	
	Calcium	0	2	19 (8.88)
	Calcium Gluconate	0	7	
	Zink	1	3	
Fluids and Electrolyte Imbbalances	Sodium Bicarbonate	0	4	4 (7.84)
Insulin	Insulin Aspart	1	10	
	Insulin glargine	1	1	16 (31.37)
	Insulin Detemir	0	3	

Drug Class	Medicine name	Stage 2 - 3	Stage 4 - 5	Frequency (%) N=51
Mineral and Trace Element	Ferrous Sulfate	0	3	3 (5.88)
Nitrate	Isosorbide Dinitrate	0	3	3 (5.88)
Thyroid Hormones	Levothyroxine	0	2	2 (3.92)
Statin	Atorvastatin	1	2	5 (9.80)
	Simvastatin	0	2	
Supplements and Adjuvant Therapy	VIP Albumin ®	1	8	9 (17.65)
Vitamins and Trace Element	Aminefron®	12	14	50 (98.04)
	Folic Acid	0	7	
	Curvit ®	2	3	
	Mecobalamin	2	4	
	Neurosanbe ®	0	6	

The first therapy given to hospitalised patients is furosemide. Furosemide is a loop diuretic drug indicated for hypertension and cardiovascular patients. Diuretics are generally required to manage extracellular fluid volume expansion and blood pressure control in chronic kidney disease. The results of this study indicated that the diuretic classes furosemide, spironolactone and hydrochlorothiazide were given to patients with stage 5. Furosemide is a line of therapy for patients with chronic kidney disease with stages 4 and 5. As for patients with chronic kidney disease stages 1-3, thiazide-class drugs such as hydrochlorothiazide are recommended. Meanwhile, spironolactone is an effective mineralocorticoid receptor antagonist diuretic for managing refractory hypertension. Nevertheless, spironolactone can cause hyperkalemia or a reversible decrease in kidney function, especially among patients with low GFR (Cheung et al., 2021). Spironolactone should be avoided at GFR <10 mL/minute or stage 5 (Ashley and Dunleavey, 2019). This is because using spironolactone in hospitalised patients with chronic kidney disease stage 5 has the risk of causing life-threatening hyperkalemia (Ashley and Dunleavey, 2019; Chua, Lo, and Lo, 2010). The study results showed that spironolactone could be used in stage 5 chronic kidney disease patients for short-term therapy if monitoring of potassium levels was carried out strictly by (Chua et al., 2010).

The second therapy given to inpatients is aminefron®. Aminefron® belongs to the vitamins and trace elements group with the composition Alpha-keto Isoleucine Ca salt 67 mg, Alpha-keto Leucine Ca salt 101 mg, Alpha-keto Phenylalanine Ca salt 68 mg, Alpha-Hydroximethionine Ca salt 59 mg, Alpha-Ketovaline Ca salt 86 mg, L-Tryptophan 23 mg, L-Threonine 53 mg, L-Histidine 38 mg, L- Tyrosine 30 mg, L-Lysine Acetate 105 mg. Aminefron® is an essential amino acid that is indicated to improve nutritional deficiencies caused by dietary protein in chronic kidney disease patients. Amino acid supplementation can reduce the sensation of anorexia and significantly improve overall nutritional status in malnourished chronic kidney disease patients, especially the elderly. Amino acid supplementation can substantially reduce the risk of starting long-term dialysis so that it becomes an adjunct therapy to

slow the development of chronic kidney disease (Wu et al., 2017). Chronic kidney disease patients who received aminefron® in the study were at stages 2, 4 and 5. Aminefron® can be used in chronic kidney disease patients with a GFR <30 mL/minute/1.73m2 or disease stages 4 and 5 (Wu et al., 2017).

The third therapy given is ceftriaxone which belongs to the cephalosporin class of antibiotics. The antibiotic ceftriaxone is indicated for the treatment of infection. Where in this study, the most common condition was pneumonia. Ceftriaxone is a community and hospital pneumonia therapy regimen (DiPiro, 2020). This drug is given to patients with chronic kidney disease at stages 4 and 5. Meanwhile, ceftriaxone can be given to patients with chronic kidney disease without needing dose adjustments (Ashley and Dunleavey, 2019).

The following therapy is candesartan. Candesartan is in a class of drugs called angiotensin II receptor blockers. Candesartan is given to patients with chronic kidney disease stages 3, 4 and 5. Candesartan can be given to patients with chronic kidney disease at stages 1 to 5 without needing dose adjustments (Ashley and Dunleavey, 2019; Reilly Lukela et al., 2019). Treatment with angiotensin II receptor blockers for hypertension in chronic kidney disease patients with or without diabetes. Therapy with angiotensin II receptor blockers is recommended for all chronic kidney disease patients, especially those with albuminuria and ACE inhibitor class drugs. Patients with angiotensin II receptor blockers have the potential to experience hyperkalemia or decreased glomerular filtration rate after starting therapy with this class of drugs. Monitor potassium level and glomerular filtration rate should be carried out 1-2 weeks after initiation or dose increase. If hyperkalemia occurs, limit dietary potassium intake, treat metabolic acidosis, if necessary, consider using thiazide or loop diuretic drugs to increase potassium excretion, and treat with potassium-binding exchange resins (Vassalotti et al., 2016).

Then insulin aspart therapy. Insulin aspart belongs to the class of insulin drugs where glargine and detemir are used in research. Insulin aspart and glargine are given to patients with chronic kidney disease stages 2, 4 and 5. Meanwhile, insulin detemir is passed to stage 5 disease. Insulin is indicated as a therapy for diabetes mellitus. The benefits of glycemic control in patients with chronic kidney disease include slowing the development of albuminuria and reducing the loss of kidney function over time. Insulin is mainly excreted through the kidneys, so the dose needs to be reduced if the GFR is <30 mL/minute/1.73m^2 (Vassalotti et al., 2016). Other literature explains in more detail that insulin aspart, glargine and detemir do not require dose adjustments in patients with chronic kidney disease stages 3, 4 and 5 (Hahr and Molitch, 2015). Insulin in research is also indicated as a therapy for hyperkalemia. Insulin is administered with glucose intravenously to move potassium from the blood into the cells (National Institute for Health and Care Excellence, 2019).

The subsequent therapy is calcium gluconate, a class of electrolytes and minerals. This drug is indicated as a therapy for hyperkalemia in chronic kidney disease patients. Calcium gluconate is given intravenously to protect the heart if the patient has hyperkalemia based on an EKG (electrocardiogram). Calcium gluconate stabilises the membrane by reducing cell membrane depolarisation, so it is an antagonist of cardiac effects (Yamanoglu and Yamanoglu, 2022). Ca-gluconate is only effective in significant rhythm disturbances due to hyperkalemia and in patients with normal calcium levels (Yamanoglu and Yamanoglu, 2022; Yusri, Amalia, and Lisni, 2018). The study showed that calcium gluconate was given to patients with stage 5 chronic kidney disease. The use of this drug in patients with chronic kidney disease does not need a dose adjustment (Ashley and Dunleavey, 2019). In addition, polystyrene calcium is a cation exchange compound drug class indicated as a therapy for hyperkalemia. Calcium polystyrene sulphate works by exchanging calcium ions in the drug with potassium in the body so that the drug binds to potassium in the large intestine. Then the medicine is excreted with potassium through the faeces (Yu, Yeo, Park, Lee, and Kim, 2017; Yusri et al., 2018). The study showed that calcium polystyrene sulphate was given to stage 5 patients. This drug was not affected by chronic kidney d, so it could be used by (Yu et al., 2017).

The results showed that the ACE Inhibitor class of drugs given to patients were lisinopril and ramipril. Patients with chronic kidney disease receiving lisinopril are at stages 2 and 4, while ramipril is at stage 5. Lisinopril and ramipril can be given to patients with chronic kidney disease at stages 3 to 5 but with a dose adjustment. Where to start with a lower dose in patients with a GFR <45 mL/minute/1.73 m^2 (Ashley and Dunleavey, 2019; Reilly Lukela et al., 2019; Vassalotti et al., 2016).

Furthermore, the class of beta-blocker drugs given to patients is bisoprolol. Bisoprolol is given to patients with chronic kidney disease at stage 4 and above. Bisoprolol can be used in patients with chronic kidney disease stages 3 to 5 but with dose adjustments (Ashley and Dunleavey, 2019; Reilly Lukela et al., 2019; Vassalotti et al., 2016).

This study found that comorbid anaemia affects many patients. However, the anaemia therapy given, such as iron and folic acid, is of limited use. This is because the majority of chronic kidney disease patients receive blood transfusions. Iron and folic acid therapy is given to patients with chronic kidney disease stages 4 and 5. Both treatments can be given to patients with chronic kidney disease without needing dose adjustments. Patients with chronic kidney disease stage 3 are advised to check their haemoglobin (Hb) levels at least annually because erythropoietin production decreases with low glomerular filtration rates (Vassalotti et al., 2016). Management of CKD anaemia includes erythropoiesis-stimulating agents, oral and intravenous iron and blood transfusions (Guedes et al., 2020). Iron therapy by oral or intravenous route is necessary for managing anaemia in chronic kidney

disease if the haemoglobin value is less than 12-13 g/dL. Patients with persistent haemoglobin levels below 10 g/dL can be referred to a nephrologist for therapy with erythropoiesis-stimulating agents (Chen, Knicely, and Grams, 2019). Initiation of erythropoiesis-stimulating agents therapy mainly for patients with chronic kidney disease non-dialysis and Hb, 10 g/dl taking into account factors such as decreased Hb, risks associated with the use of erythropoiesis-stimulating agents and risks of blood transfusions (Guedes et al., 2020).

Cardiovascular heart disease was experienced by many patients in this study. Treating chronic kidney disease patients with comorbid cardiovascular heart disease includes dyslipidemia and anti-hypertension therapy (Bello et al., 2017). Statin therapy is the recommended therapy (Vassalotti et al., 2016). This study found that atorvastatin therapy was given to patients with chronic kidney disease at stages 2, 4 and 5. Meanwhile, simvastatin was given to patients with disease stages 4 and 5. Atorvastatin can be used without needing dose adjustments in patients with chronic kidney disease. Meanwhile, simvastatin needs a dose adjustment at stage 5 (Ashley and Dunleavey, 2019).

The results of the complete analysis in this study can be seen in Table 4. Based on the results of the analysis, chronic kidney disease patients who are hospitalised receive several renal risk drugs that require dose adjustments and also need to be avoided. The renal risk drugs in this study included drugs that needed dose adjustments, namely lisinopril, ramipril, cefixime, cefotaxime, meropenem, levofloxacin, ciprofloxacin, bisoprolol, diltiazem and simvastatin. Meanwhile, hydrochlorothiazide and spironolactone are renal-risk drugs that must be avoided. This study's results align with the research (Deskur-Śmielecka et al., 2019). However, further research is needed regarding the application of dose adjustments in health facilities because this study only examines theoretically (recommendations). Correct dosage adjustment in chronic kidney disease patients can affect therapy outcomes and quality of life and contribute to health care costs. Moreover, dosage adjustments minimise drug side effects (Kassa Birarra, Mekonnen, Gelayee, Assimamaw, and Kifle, 2022).

Table 4. Analysis of the Use of Renal Risk Drugs in Patients with Chronic Kidney Diseases

Drug Class	Medicine name	Recommendations for Drug Use in Chronic Kidney Disease	Reference
ACE *Inhibitor*	Lisinopril	Dosage adjustment is required in stages 3 to 5	Ashley and Currie 2019, Lukela et al. 2019
	Ramipril	Dosage adjustment is required in stages 3 to 5	Ashley and Currie 2019, Lukela et al. 2019
Angiotensin II Receptor Blockers	Candesartan	No need for dosage adjustment	Ashley and Currie 2019, Lukela et al. 2019
Macrolide Antibiotics	Azithromycin	No need for dosage adjustment	Ashley and Currie 2019
Aminoglycoside antibiotics	Gentamicin	Needs dose adjustment	Ashley and Currie 2019
Cephalosporin Antibiotics	Cefixime	Dosage adjustment is required in stage 5	Ashley and Currie 2019

Drug Class	Medicine name	Recommendations for Drug Use in Chronic Kidney Disease	Reference
	Cefotaxime	Dosage adjustment is required in stage 5	Ashley and Currie 2019
	Ceftriaxone	No need for dosage adjustment	Ashley and Currie 2019
Carbapenem Antibiotics	Meropenem	Dosage adjustment is required in stages 3 to 5	Ashley and Currie 2019
Nitroimidazole antibiotics	Metronidazole	No need for dosage adjustment	Ashley and Currie 2019
Quinolone Antibiotics	Levofloxacin	Dosage adjustment is required in stages 3 to 5	Ashley and Currie 2019
	Ciprofloxacin	Dosage adjustment is required in stages 3 to 5	Ashley and Currie 2019
Anti-platelet	Aspirin	No need for dosage adjustment	Ashley and Currie 2019
	Clopidogrel	No need for dosage adjustment	Ashley and Currie 2019
Beta *blocker*	Bisoprolol	Dosage adjustment is required in stages 3 to 5	Ashley and Currie 2019, Lukela et al. 2019
Calcium Channel Blockers	Amlodipine	No need for dosage adjustment	Ashley and Currie 2019
	Diltiazem	Dosage adjustment is required in stage 5	Ashley and Currie 2019
	Nicardipine HCl	There is no need for dose adjustment for the oral route and no need for dose adjustment for the intravenous route.	Ashley and Currie 2019
Centrally Acting Alpha Agonist	Clonidine	No need for dosage adjustment	Ashley and Currie 2019
Diuretic	Furosemide	No need for dosage adjustment	Ashley and Currie 2019, Lukela et al. 2019
	Hydrochlorothiazide	Avoided at stage 5	Ashley and Currie 2019, Lukela et al. 2019
	Spironolactone	Avoided at stage 5	Ashley and Currie 2019, Lukela et al. 2019
Insulin	Insulin Aspart	No need for dosage adjustment	Hahr and Molitch 2015
	Insulin glargine	No need for dosage adjustment	Hahr and Molitch 2015
	Insulin Detemir	No need for dosage adjustment	Hahr and Molitch 2015
Mineral and Trace Element	Ferrous Sulfate	No need for dosage adjustment	Hahr and Molitch 2015
Nitrate	Isosorbide Dinitrate	No need for dosage adjustment	Ashley and Currie 2019
Thyroid Hormones	Levothyroxine	No need for dosage adjustment	Ashley and Currie 2019
Statin	Atorvastatin	No need for dosage adjustment	Ashley and Currie 2019
	Simvastatin	Dosage adjustment is required in stage 5	Ashley and Currie 2019
Vitamins and Trace Element	Folic Acid	No need for dosage adjustment	Ashley and Currie 2019

CONCLUSION

The diuretic class furosemide is the most widely used therapy in chronic kidney disease patients hospitalised at disease stages 4 and 5. The chronic kidney disease patients hospitalised receive several renal risk drugs, which in the literature need dose adjustments, and some need to be avoided.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

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