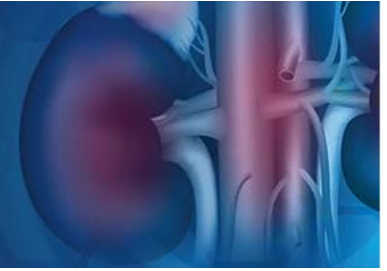


International Journal of Nephrology Research



ISSN Print: 2664-6692
ISSN Online: 2664-6706
IJNR 2024; 6(1): 20-24
www.nephrologyjournal.in
Received: 08-04-2024
Accepted: 20-05-2024

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Prescription pattern and common complications in maintenance hemodialysis patients

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DOI: <https://doi.org/10.33545/26646692.2024.v6.i1a.11>

Abstract

Background: Maintenance hemodialysis (MHD) is vital for managing end-stage renal disease (ESRD), but it requires careful prescription of dialysis frequency, session duration, and medications. Common complications include cardiovascular issues, electrolyte imbalances, and infections, affecting patient outcomes. This study aimed to evaluate current prescription practices and identify prevalent complications in maintenance hemodialysis (MHD) patients.

Methods: This prospective observational study was conducted in the Department of Nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from September 2023 to February 2024. A total of 57 end-stage (Stage-V) renal disease patients over the age of 18, undergoing maintenance hemodialysis 2 or 3 times per week, were purposively selected for this study. Information regarding their demographic and clinical characteristics, comorbidities, and current medications was collected. The data were then processed, analyzed, and presented using MS Office tools.

Results: Cardiovascular, gastrointestinal, and anti-diabetic drugs were prescribed in 63.2%, 71.9%, and 54.4% of participants, respectively. Calcium channel blockers and ACE inhibitors were used by over 20% of patients, while 64.9% received proton pump inhibitors. Half of the patients (50.9%) were on oral anti-diabetics. In this study, 63% of participants were receiving maintenance hemodialysis twice a week, while 37% were undergoing it three times per week. In over 40% of participants, chest pain and muscle cramps, and in more than 25%, pneumonia, nausea, vomiting, itching, and anemia were identified as intradialytic complications. These were more common in patients undergoing maintenance hemodialysis twice weekly, except for anemia and volume overload.

Conclusion: Cardiovascular, gastrointestinal, and anti-diabetic drugs are commonly prescribed for maintenance hemodialysis (MHD) patients, with calcium channel blockers, ACE inhibitors, proton pump inhibitors, and oral anti-diabetics being the most frequent. Some MHD patients may experience complications such as nausea, muscle cramps, fever, chest pain, and back pain.

Keywords: Chronic kidney diseases, Complications, Maintenance hemodialysis, Nausea, Prescription pattern

Introduction

In today's world, the prevalence of chronic kidney disease (CKD) is on the rise due to factors such as aging, polypharmacy, and drug interactions^[1]. CKD is diagnosed when the glomerular filtration rate drops below 60 mL/min/1.73 m² for three or more months, alongside abnormalities in kidney structure or function^[2]. Being a non-communicable disease, CKD has several significant risk factors including diabetes, hypertension, glomerulonephritis, a family history of CKD, polycystic kidney disease, alcohol use, and chronic use of non-steroidal anti-inflammatory drugs^[3]. CKD patients face a higher risk of cardiovascular complications and end-stage renal disease (ESRD), often leading to prolonged hospital stays and increased mortality^[4]. Chronic kidney disease (CKD) is a major global cause of mortality, according to Global Burden of Disease studies^[5, 6]. In India, the prevalence of CKD is approximately 17.2%, with about 6% of the population experiencing Stage 3 or higher. CKD is more prevalent in males, influenced by factors such as alcoholism, smoking, obesity, and related comorbidities^[7]. A meta-analysis of nine studies involving 225,206 participants in Bangladesh revealed a CKD prevalence of 22.48%, which is notably higher than the global average^[8, 9]. In the initial stages of chronic kidney disease (CKD), symptoms are usually mild or absent, but as the condition worsens, patients may develop uremia, nausea, vomiting, loss of appetite, drowsiness, and confusion^[1].

Due to the fluctuating nature of chronic renal failure, frequent adjustments to medications during dialysis are often necessary. CKD patients are typically on multiple medications, which increases the likelihood of adverse drug reactions caused by drug interactions, leading to reduced effectiveness of treatments and poor adherence to prescribed regimens [10]. In patients with CKD, antimicrobials are frequently prescribed due to their increased risk of infections. It is crucial to adjust the dosage of all medications, including antibiotics, to prevent drug interactions and further renal damage [11]. Treatment strategies for CKD vary based on the stage of the disease, with options like dialysis and kidney transplantation considered in more advanced stages. Although hemodialysis is a life-saving treatment for patients with end-stage renal disease (ESRD) and is generally considered a safe procedure, with a mortality rate of 1 in 75,000 treatments, it is not without risks [13]. The procedure can lead to various complications, some of which are acute and occur during or immediately after the session, while others develop as chronic conditions over time [14].

Methodology

This was a prospective observational study that took place in the Department of Nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from September 2023 to February 2024. A total of 57 end stage renal disease patients, all above 18 years old and undergoing maintenance hemodialysis 2-3 times/week, were purposively selected, most of the patients on twice weekly MHD for this study. The inclusion criteria consisted of all chronic kidney disease (CKD) patients over 18 years who were undergoing hemodialysis. The exclusion criteria included patients undergoing hemodialysis for acute renal failure (ARF) and those unwilling to provide consent. Informed consent was obtained from all participants before data collection. The entire intervention was conducted following the principles of human research outlined in the Helsinki Declaration [15] and executed in compliance with applicable regulations, including the provisions of the General Data Protection

Regulation (GDPR) [16]. Information regarding participants' demographic and clinical characteristics, comorbidities, and current medications was collected. Data analysis was performed using MS Office tools.

Results

In this study, the majority of participants (56.1%) were aged between 36-60 years. Of the total participants, 56% were male and 44% were female, with a male-to-female ratio of 1.3:1. Common comorbidities included hypertension (64.2%) and diabetes mellitus (54.5%), glomerulonephritis (GN) (25%). Additionally, some participants had hypothyroidism (14.6%), neuropathy (11.4%), chronic obstructive pulmonary disease (COPD) (5.7%), and ischemic heart disease (IHD) (2.4%). In analyzing the prescription patterns among our participants, it was observed that the majority were prescribed one or more cardiovascular (63.2%), gastrointestinal (71.9%), and/or anti-diabetic (54.4%) medications. Additionally, some patients were prescribed respiratory drugs, hematopoietic agents, phosphate binders, vitamins and minerals, antibiotics, and other medications. Among cardiovascular drugs, calcium channel blockers and ACE inhibitors were prescribed in over 20% of the patients. In terms of gastrointestinal medications, proton pump inhibitors were prescribed in 64.9% of the cases. Nearly half of the patients (50.9%) were taking oral anti-diabetics. In this study, 63% of participants were taking twice/week and 37% were taking thrice/week maintenance hemodialysis. In over 40% of participants, chest pain and muscle cramps were identified as intradialytic complications. Additionally, more than one-quarter of the participants experienced pneumonia, nausea, vomiting, itching, and anemia.

Table 1: Age distribution of participants (N=57)

Age (Year)	n	%
19-35 yrs.	13	22.8%
36-60 yrs.	32	56.1%
>60 yrs.	12	21.1%

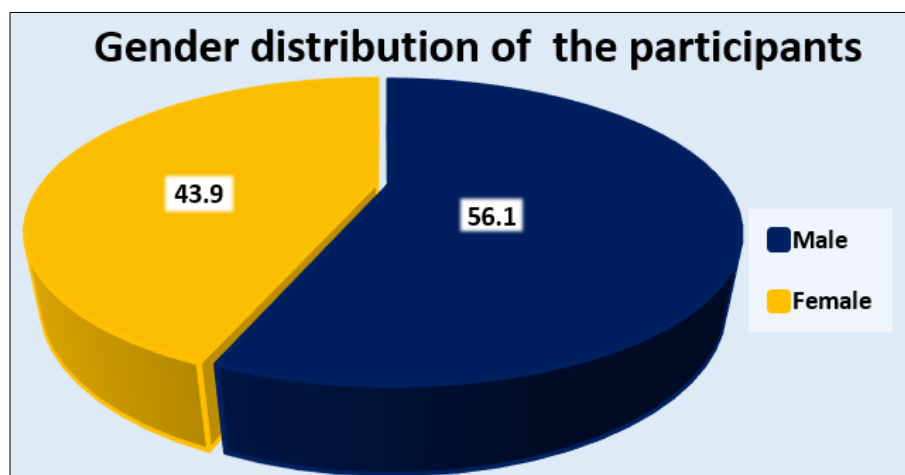


Fig 1: Pie chart showed gender wise patients distribution (N=57)

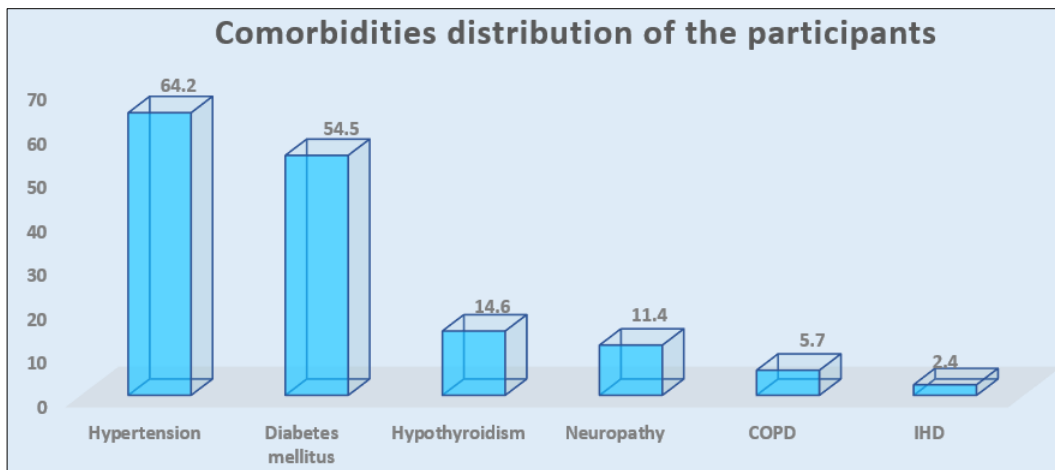


Fig 2: Column chart showed distribution of comorbidities (N=57)

Table 2: Prescription patterns

Drug type	n	%
Cardiovascular drugs	36	63.2%
Anti-diabetics	31	54.4%
Respiratory drugs	4	7.0%
Hematopoietic	5	8.8%
Phosphate binders	4	7.0%
Vitamins and minerals	6	10.5%
Antibiotics	5	8.8%
Some other drugs	8	14.0%

Table 3: Drug distribution of participants

Drugs	n	%
Cardiovascular drugs		
Calcium channel blockers	15	26.3%
Diuretics	5	8.8%
ACE inhibitor	12	21.1%
Angiotensin receptor blocker	9	15.8%
Beta-blocker	10	17.5%
Alfa 2 agonist	5	8.8%
Gastrointestinal drugs		
Proton pump inhibitors	37	64.9%
Anti-diabetics		
Oral anti-diabetics	29	50.9%
Insulin	4	7.0%
Respiratory drugs		
Bronchodilators	4	7.0%
Hematopoietic		
Iron	4	7.0%
Folate	3	5.3%
Erythropoietin	2	3.5%
Darbepoetin	1	1.8%
Phosphate binders		
Calcium carbonate	4	7.0%
Sevelamer	2	3.5%
Vitamins and minerals		
Calcitriol	1	1.8%
Antibiotics		
Ceftriaxone	1	1.8%
Azithromycin	2	3.5%
Moxifloxacin	1	1.8%

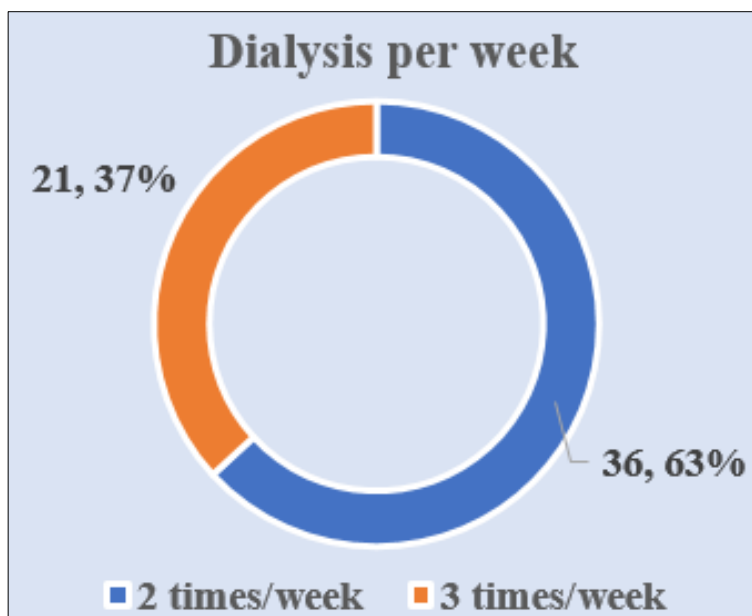


Fig 3: Distribution of participants as per dialysis schedule per week (N=57)

Table 4: Distribution of complications among the participants

Complication	Patients as per maintenance dialysis/week				Total	
	Twice/week		Thrice/week		2-3 times/week	
	(n=36)		(n=21)		(n=57)	
Chest pain	19	52.8%	7	33.3%	26	45.6%
Muscle cramp	16	44.4%	9	42.9%	25	43.9%
Pneumonia	11	30.6%	5	23.8%	16	28.1%
Low back pain	4	11.1%	2	9.5%	6	10.5%
Nausea-vomiting	15	41.7%	7	33.3%	22	38.6%
Itching	14	38.9%	8	38.1%	22	38.6%
Anemia	10	27.8%	6	28.6%	16	28.1%
Volume overload	7	19.4%	6	28.6%	13	22.8%
Heart failure	4	11.1%	2	9.5%	6	10.5%
Death by arrhythmia	2	5.6%	1	4.8%	3	5.3%

Discussion

In this study, 57 renal disease patients, all above 18 years old and undergoing maintenance hemodialysis, were purposively selected. The majority of participants belonged to the 36-60 years’ age group, similar to the study by Oommen *et al.*, where the mean age was 49.53 (±15.09) years [17]. Among the participants in our study, 56% were male, resulting in a male-to-female ratio of 1.3:1. Male predominance was also observed in a previous study by M. Ali *et al.* [13]. Hypertension and diabetes mellitus were the most common comorbidities observed, while other conditions like chronic obstructive pulmonary disease, ischemic heart disease, hypothyroidism, diabetic neuropathy were also present in some cases. These comorbidities have been noted in previous studies [13, 17], though the frequency of individual conditions varied. In analyzing the prescription patterns of our participants, we found that the majority were prescribed one or more cardiovascular, gastrointestinal, and/or anti-diabetic medications. Additionally, respiratory drugs, hematopoietic agents, phosphate binders, vitamins, minerals, and antibiotics were prescribed in some cases. A similar trend in prescription patterns was observed in a recent study by S Chakraborty *et al.* [18]. In our study, calcium channel blockers and ACE inhibitors were among the most commonly prescribed cardiovascular drugs, given to over one-fifth of the patients. As for gastrointestinal medications, proton pump inhibitors were the most commonly prescribed. Nearly half of the

participants were on oral anti-diabetic medications. Regarding complications, more than 5% of the patients experienced issues such as nausea, muscle cramps, fever, chest pain, and back pain. Similar complications were reported by M Ali *et al.* [13]. The findings of this study could provide valuable insights for future research.

Limitation of the study

This was a single-centered, cross-sectional study with a small sample size and conducted over a short period. As a result, the findings may not fully capture or reflect the broader scenario across the entire country, limiting the generalizability of the study’s conclusions.

Conclusion & Recommendation

Cardiovascular, gastrointestinal, and anti-diabetic drugs are frequently prescribed to maintenance hemodialysis (MHD) patients. Among these, calcium channel blockers, ACE inhibitors, proton pump inhibitors, and oral anti-diabetic medications are commonly used. Despite the benefits of these treatments, some MHD patients may experience complications such as nausea, muscle cramps, fever, chest pain, and back pain. Proper monitoring and individualized treatment plans are essential to manage these side effects and optimize patient outcomes, ensuring a better quality of life for individuals undergoing long-term hemodialysis

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How to Cite This Article

Alam MR, Hasan R, Jahan F. Prescription pattern and common complications in maintenance hemodialysis patients. *International Journal of Nephrology Research.* 2024;6(1):20-24.

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