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Prescription Pattern Of Antihypertensive Drug In Hemodialysis Patient– A Review

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ABSTRACT

Hypertension is common among patients receiving hemodialysis and significantly contributes to their risk of cardiovascular complication and mortality. Managing blood pressure in these patients is challenging due to changes in drug metabolism , fluid shifts, and coexisting medical conditions. This review examines current evidence on how antihypertensive medications are prescribed in this population, highlighting the most frequently used drug classes, factors influencing prescription choices, and opportunities for improvement. Calcium channel blockers, beta- blockers, and agents targeting the renin-angiotensin system are commonly utilized, though practices vary globally. Better understanding of these patterns can enhance treatment strategies and patient outcomes.

Key Words : Antihypertensive drug, Hemodialysis Patients.

INTRODUCTION

Hypertension is one of the most prevalent comorbid conditions in patients undergoing maintenance hemodialysis, affecting nearly 70–90% of this population. It represents a major risk factor for cardiovascular morbidity and mortality, contributing to complications such as left ventricular hypertrophy, stroke, heart failure, and premature death. The pathophysiology of hypertension in hemodialysis is multifactorial, involving volume overload, activation of the renin–angiotensin– aldosterone system,

heightened sympathetic nervous system activity, and increased arterial stiffness. Effective blood pressure management in these patients is challenging due to frequent fluid and electrolyte fluctuations, multiple comorbidities, and altered pharmacokinetics associated with end-stage renal disease. The selection of antihypertensive agents for patients on hemodialysis requires careful consideration of factors such as dialyzability, side-effect profiles, cardiovascular protection, and the presence of conditions like diabetes or ischemic heart disease. Understanding prescription patterns not only reflects current clinical practices but also helps identify gaps in therapy, optimize blood pressure control, and improve patient outcomes in this high-risk group.

CAUSES OF HYPERTENSION IN HEMODIALYSIS

Hypertension in HD patients is multifactorial. Key contributing factors include:

•**Volume Overload:** Inadequate ultrafiltration or excess sodium intake leads to fluid retention, increasing blood volume and pressure.

•**Activation of the Renin-Angiotensin-Aldosterone System (RAAS)**: Reduced renal perfusion triggers RAAS, causing vasoconstriction and sodium retention.

•**Sympathetic Nervous System Activation**: Increased sympathetic tone raises heart rate and peripheral resistance.

•**Arterial Stiffness and Vascular Calcification**: Common in ESRD, resulting in elevated systolic pressures.

•**Endothelial Dysfunction:** Impaired nitric oxide production reduces vasodilation capacity.

•**Anemia and Erythropoietin Therapy**: Both can influence vascular tone and blood pressure regulation.

•**Sleep Apnea**: Frequently seen in dialysis patients, contributing to hypertension.

•**Use of Medications**: Certain drugs, such as erythropoiesis-stimulating agents and NSAIDs, may raise blood pressure.

PATHOPHYSIOLOGY OF HYPERTENSION IN HEMODIALYSIS PATIENTS:

High blood pressure in patients on hemodialysis results from a variety of interconnected causes:

•Between dialysis treatments, the body often retains too much salt and water, which increases blood volume and raises blood pressure. Controlling this fluid buildup is essential for managing hypertension.

•The blood vessels themselves undergo changes due to chronic kidney disease and the accumulation of toxins, leading to hardening and loss of elasticity. This vascular stiffening causes higher systolic pressure and greater strain on the heart.

•The nervous system's regulation of blood pressure is impaired because the sensors that detect blood pressure changes (baroreceptors) don't work properly, causing overactivation of the sympathetic nervous system. This leads to constricted blood vessels and faster heart rate, both of which elevate blood pressure.

•The hormone system known as the renin-angiotensin-aldosterone system (RAAS) becomes overly active, promoting narrowing of blood vessels and retention of salt and water, which contribute to sustained hypertension.

•Treatment with erythropoietin to combat anemia in dialysis patients can unintentionally increase vascular resistance, further raising blood pressure.

•Additional factors such as chronic inflammation, oxidative damage, and dysfunction of the blood vessel lining also play roles in maintaining elevated blood pressure levels in this group.

Due to the complexity of these factors working together, managing hypertension in hemodialysis patients often requires a combination of different blood pressure medications. This polytherapy approach can make it more challenging for patients to consistently follow their medication schedules.

COMMON CLASSES OF DRUG IN ANTIHYPERTENSIVE PATIENT :

Common Classes of Antihypertensive Drugs in Hemodialysis Patients

1Calcium Channel Blockers (CCBs)

•Widely prescribed because they are effective, safe, and not removed by dialysis.

•Agents like amlodipine and nifedipine are common choices.

•They also reduce left ventricular mass and improve cardiovascular outcomes in ESRD patients.

2.Beta Blockers

•Beneficial in controlling sympathetic overactivity, arrhythmias, and cardiac events.

•Lipid-soluble drugs (carvedilol, propranolol) are less affected by dialysis, whereas water-soluble ones (atenolol, metoprolol) may require adjustment or post-dialysis dosing.

•Carvedilol has demonstrated added benefit in HD patients with heart failure.

3.ACE Inhibitors (ACEIs) and Angiotensin Receptor Blockers (ARBs)

•Provide cardiovascular and renal protective effects.

•Main limitation is hyperkalemia, making them less frequently prescribed in HD patients compared to non-dialysis CKD.

4.Centrally Acting Agents

•Drugs such as clonidine and methyldopa are used mainly in resistant hypertension.

•Side effects like drowsiness restrict their routine use.

5.Vasodilators

•Hydralazine and minoxidil are reserved for severe or resistant hypertension.

•Require use alongside beta blockers or diuretics to prevent reflex tachycardia and edema.

6.Diuretics

•Still useful in patients with residual urine output.

•Loop diuretics (furosemide, torsemide) can control volume overload, but have minimal role in anuric patients.

COMMONLY PRESCRIBED ANTIHYPERTENSIVE DRUG:

Drug class	Examples	Moa	Advantages in HD Patients	Limitations
Calcium Channel blockers	Amlodipine,Nifedipine	Block L type calcium channel causing vasodilation	Effective bp control minimal Removal during dialysis.	Peripheral edema
Beta – Adrenergic Blockers	Metoprolol,carvedilol	Block beta adrenergic receptors,reduce cardiac output	Used in ischemic heart disease and arrhythmias	Dosing adjustable
Renin Angiotensin system Inhibitor	Lisinopril, Losartan	Inhibit RAAS,reduce vasoconstriction and aldosterone	Cardiovascular protection reduce proteinuria	Risk of hyperkalemia
Diuretics	Furosemide,Torsemide	Promote sodium and water excretion	Useful in patients with residual renal function	Limited efficacy in anuric patients
Alpha blockers	Prazosin	Block apha adrenergic receptors causing vasodilation	Beneficial in resistant hypertension	Postural hypotension
Central Alpha agonist	clonidine	Decrease sympathetic outflow	Used in resistant hypertension	Sedation

FACTORS AFFECTING PRESCRIPTION PATTERN:

Patient Characteristics

Age, cardiovascular status, presence of diabetes, and remaining kidney function influence drug selection. • Electrolyte imbalances, especially potassium levels, may limit certain medications.

Drug Properties :
Dialyzability, half-life, and adverse effect profile affect timing and dosing. Simpler dosing schedules improve medication adherence.

Dialysis Factors

Frequency and length of dialysis sessions impact drug clearance and side effects such as hypotension.

Healthcare System Variables

Availability, cost, and local guidelines influence drug choices.

CLINICAL CHALLENGES:

- Balancing volume control and antihypertensive therapy to avoid intradialytic hypotension.
- Managing polypharmacy and potential drug interactions.
- Ensuring patient adherence despite complex regimens.
- Adjusting drug doses in relation to dialysis sessions.

CONCLUSION :

Hypertension remains a highly prevalent and clinically significant problem in patients undergoing hemodialysis, contributing to increased cardiovascular morbidity and mortality. The prescription pattern of antihypertensive drugs in this population reflects a delicate balance between controlling blood pressure, minimizing adverse effects, and addressing the unique pharmacokinetic alterations associated with end-stage renal disease. Calcium channel blockers, beta-blockers, renin–angiotensin system inhibitors, and centrally acting agents are frequently prescribed, often in combination, to achieve optimal blood pressure control. Drug selection is guided by factors such as dialyzability, comorbid conditions, patient tolerance, and potential cardiovascular protective effects. Regular review of prescribing trends, along with individualized therapy and patient education, is essential to improve adherence and clinical outcomes. Future research should focus on comparative effectiveness studies and long-term safety profiles of antihypertensive agents in hemodialysis, to refine evidence-based prescribing practices and enhance quality of care.

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