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Original Research Article

A Hospital-Based Study of Antihypertensive Drug Prescription Patterns and Their Impact on Blood Pressure (BP) Outcomes

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Abstract:

Background: Hypertension is one of the most prevalent non-communicable diseases globally and a major risk factor for cardiovascular, cerebrovascular, and renal morbidity and mortality. Rational use of antihypertensive drugs plays a critical role in blood pressure (BP) control, yet prescribing practices often vary widely, particularly in resource-constrained healthcare settings.

Aim: To evaluate the prescribing patterns of antihypertensive drugs and assess their impact on blood pressure outcomes in a tertiary care hospital.

Methods: A cross-sectional, observational study was conducted over nine months in the Department of Pharmacology at ICARE Institute of Medical Sciences and Research, Haldia. A total of 145 outpatient prescriptions for patients diagnosed with essential hypertension were analyzed. Data on demographics, drug classes prescribed, monotherapy vs. polytherapy, use of fixed-dose combinations (FDCs), and pre- and post-treatment BP readings were collected and statistically analyzed.

Results: Calcium channel blockers (34.5%) and angiotensin receptor blockers (28.3%) were the most commonly prescribed drug classes. Monotherapy was observed in 57.9% of cases, while 42.1% received combination therapy. Fixed-dose combinations were used in 26.2% of prescriptions. Significant BP reduction was observed in patients receiving combination therapy compared to monotherapy ($p < 0.05$). Generic prescribing accounted for 63.4% of total prescriptions.

Conclusion: The study revealed adherence to evidence-based antihypertensive prescribing, with a growing trend toward rational combination therapy and use of FDCs. Regular prescription audits and guideline-based interventions may further improve BP control and reduce complications associated with hypertension.

Introduction

Hypertension is one of the most prevalent chronic non-communicable diseases worldwide and remains a leading modifiable risk factor for cardiovascular disease, stroke, renal failure, and premature mortality. According to the World Health Organization (WHO), an estimated 1.28 billion adults aged 30–79 years worldwide have hypertension, and over 700 million of them are unaware of their condition [1]. In India, the National Family Health Survey-5 (2019–2021) reported that approximately 24% of men and 21% of women aged 15 and above suffer from elevated blood pressure, with urban populations bearing a greater burden due to lifestyle factors such as obesity, stress, and sedentary behavior [2].

Effective management of hypertension relies heavily on pharmacological intervention, particularly when lifestyle modifications alone fail to achieve target blood pressure levels [3]. The availability of several classes of antihypertensive agents including calcium channel blockers (CCBs), angiotensin-converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), beta blockers, diuretics, and newer fixed-dose combinations (FDCs) offers clinicians a broad spectrum of therapeutic options. However, inappropriate prescribing practices, non-adherence to clinical guidelines, irrational polypharmacy, and preference for branded medications over generics can significantly compromise treatment outcomes and increase healthcare costs [4,5].

Several national and international treatment guidelines, including those from the Indian Hypertension Guidelines (IHG), the Eighth Joint National Committee (JNC-8), and the European Society of Cardiology (ESC), advocate individualized antihypertensive therapy based on patient profile, comorbid conditions, and drug safety. Despite these recommendations, studies from different parts of India have shown significant

variability in drug utilization patterns, both in urban and rural healthcare settings. Moreover, the use of combination therapy and fixed-dose combinations has gained momentum due to their potential to improve adherence and control rates, especially in patients requiring multiple agents [6,7].

Periodic evaluation of prescribing patterns in institutional settings serves as an essential audit tool to monitor the rational use of antihypertensive drugs, ensure adherence to standard treatment protocols, and identify areas for intervention. Furthermore, analyzing blood pressure outcomes in relation to prescribed regimens provides important insights into the real-world effectiveness of therapy [8]. Given the scarcity of data from Eastern India, particularly from tertiary care teaching hospitals, this study was undertaken to evaluate the current antihypertensive prescription trends and their impact on blood pressure control at ICARE Institute of Medical Sciences and Research, Haldia.

Aim and Objectives

Aim: To evaluate the prescription patterns of antihypertensive drugs and assess their impact on blood pressure outcomes among patients attending a tertiary care hospital.

Objectives:

1. To analyze the demographic distribution of patients receiving antihypertensive therapy.
2. To identify the most commonly prescribed classes of antihypertensive drugs.
3. To compare the prevalence of monotherapy versus combination therapy in the management of hypertension.
4. To assess the utilization of fixed-dose combinations (FDCs) and adherence to essential medicines list and national treatment guidelines.
5. To evaluate the change in systolic and diastolic blood pressure before and after initiation of therapy.
6. To explore the association between type of drug regimen (monotherapy vs. combination therapy) and blood pressure control.
7. To study the proportion of prescriptions using generic versus branded medications.

Materials and Methods

Study Design: This was a cross-sectional, observational study based on a retrospective analysis of outpatient prescriptions and patient records.

Study Setting and Duration: The study was conducted in the Department of Pharmacology, ICARE Institute of Medical Sciences and Research, Dr. Bidhan Chandra Roy Hospital, Haldia, West Bengal. Data were collected over a period of 9 months.

Study Population: The study population included adult patients (aged ≥18 years) diagnosed with essential hypertension who were attending the outpatient department and receiving antihypertensive therapy.

Sample Size: A total of 145 prescriptions were randomly selected and analyzed.

Inclusion Criteria:

- Patients diagnosed with essential hypertension.
- Patients receiving at least one antihypertensive medication.
- Prescriptions with complete documentation of blood pressure readings.

Exclusion Criteria:

- Patients with secondary hypertension.
- Pregnant women with gestational hypertension or preeclampsia.
- Incomplete or illegible prescriptions.

Data Collection:

Data were extracted from physical and electronic outpatient records using a structured data extraction sheet. Information collected included:

- Patient demographics (age, sex)
- Baseline and follow-up systolic and diastolic blood pressure
- Antihypertensive drug(s) prescribed (class, name, dose, frequency)
- Monotherapy or combination therapy
- Use of fixed-dose combinations (FDCs)
- Generic vs. branded drug status
- Adherence to WHO Essential Medicines List
- Use of any adjunct medications

Outcome Measures:

- Classification of antihypertensive drugs and prescribing trends.
- Blood pressure control, defined as achieving <140/90 mmHg (as per JNC 8 guidelines).
- Comparative analysis of BP control between monotherapy and combination therapy groups.

Statistical Analysis: Descriptive statistics were used to present frequency distributions. Mean and standard deviation were calculated for continuous variables such as age and BP values. A paired t-test was applied to assess the difference between pre-treatment and post-treatment BP values. Chi-square test was used to evaluate associations between categorical variables. A p-value of <0.05 was considered statistically significant. Data analysis was performed using Microsoft Excel and SPSS version 25.0.

Results

A total of 145 patient prescriptions were analyzed. The study population consisted of 82 males (56.6%) and 63 females (43.4%), with the majority aged between 41–60 years. Monotherapy was prescribed in 84 cases (57.9%) and combination therapy in 61 cases (42.1%). Among drug classes, calcium channel blockers (CCBs) and angiotensin receptor blockers (ARBs) were the most frequently prescribed, followed by beta-blockers and diuretics. Fixed-dose combinations (FDCs) were present in over one-fourth of all prescriptions. Generic drug use was noted in 63.4% of cases. A statistically significant reduction in mean systolic and diastolic BP was observed after therapy, with better control among those on combination therapy. Details are presented below.

Table 1: Age-wise Distribution of Study Population

Age Group (years)	Number of Patients	Percentage (%)
18–30	10	6.9
31–40	21	14.5
41–50	37	25.5
51–60	40	27.6
>60	37	25.5

Table 2: Gender Distribution

Gender	Number of Patients	Percentage (%)
Male	82	56.6
Female	63	43.4

Table 3: Distribution of Patients According to Type of Therapy

Therapy Type	Number of Patients	Percentage (%)
Monotherapy	84	57.9
Combination Therapy	61	42.1

Table 4: Frequency of Antihypertensive Drug Classes Prescribed

Drug Class	Number of Prescriptions	Percentage (%)
Calcium Channel Blockers (CCBs)	65	34.5
Angiotensin Receptor Blockers (ARBs)	53	28.3
Beta Blockers	28	14.9
Diuretics	21	11.2
ACE Inhibitors	14	7.6
Others (alpha blockers, etc.)	7	3.5

Table 5: Commonly Prescribed Drug Combinations

Combination	Number of Patients	Percentage (%)
ARB + CCB	18	29.5
CCB + Diuretic	12	19.7
ARB + Beta Blocker	9	14.8
ARB + Diuretic	8	13.1
Others	14	23.0

Table 6: Use of Fixed-Dose Combinations (FDCs)

FDC Usage	Number of Prescriptions	Percentage (%)
Present	38	26.2
Not Present	107	73.8

Table 7: Generic vs Branded Drug Usage

Drug Type	Number of Prescriptions	Percentage (%)
Generic	92	63.4
Branded	53	36.6

Table 8: Route of Drug Administration

Route	Number of Prescriptions	Percentage (%)
Oral	145	100.0
Parenteral	0	0.0

Table 9: Frequency of Drug Administration per Day

Frequency (per day)	Number of Patients	Percentage (%)
Once Daily	89	61.4
Twice Daily	45	31.0
Thrice Daily	11	7.6

Table 10: Adjunct Medications Prescribed Alongside Antihypertensives

Adjunct Medication	Number of Patients	Percentage (%)
Statins	33	22.8
Antiplatelets	29	20.0
Antacids	18	12.4
Others	10	6.9

Table 11: Pre- and Post-Treatment Blood Pressure Readings

Parameter	Mean ± SD (mmHg)	p-value
Systolic BP (Pre-Tx)	156.4 ± 12.8	
Systolic BP (Post-Tx)	136.7 ± 11.4	<0.001
Diastolic BP (Pre-Tx)	96.5 ± 8.7	
Diastolic BP (Post-Tx)	84.2 ± 7.3	<0.001

Table 12: BP Control Achieved vs. Therapy Type

Therapy Type	BP Controlled (n/%)	BP Uncontrolled (n/%)
Monotherapy	48 (57.1%)	36 (42.9%)
Combination Therapy	45 (73.8%)	16 (26.2%)

Table 1 showed that the majority of hypertensive patients were between 41–60 years of age, indicating midlife predominance of hypertension. Table 2 revealed a male predominance (56.6%), which may be attributed to gender-based healthcare-seeking behavior or higher risk profiles. Table 3 indicated that monotherapy was slightly more common (57.9%) than combination therapy (42.1%), suggesting a cautious approach in initial management. Table 4 demonstrated that calcium channel blockers (34.5%) and angiotensin receptor blockers (28.3%) were the most frequently prescribed drug classes, aligning with current hypertension guidelines. Table 5 listed the common drug combinations, with ARB + CCB being the most frequently used (29.5%), showing a preference for dual mechanism control. Table 6 highlighted that fixed-dose combinations were used in 26.2% of prescriptions, indicating a growing shift toward improving adherence through simplified regimens. Table 7 showed that 63.4% of drugs were prescribed in their generic form, which reflects moderate implementation of cost-effective prescribing. Table 8 confirmed that all prescriptions used the oral route, which is standard in outpatient antihypertensive therapy. Table 9 found that once-daily dosing was most common (61.4%), promoting better compliance. Table 10 showed frequent co-prescription of statins (22.8%) and antiplatelets (20.0%), reflecting a focus on cardiovascular risk management. Table 11 demonstrated a statistically significant reduction in both systolic and diastolic blood pressure post-treatment ($p < 0.001$), confirming the effectiveness of therapy. Table 12 showed that patients on combination therapy achieved better BP control (73.8%) compared to those on monotherapy (57.1%), supporting the clinical benefit of rational dual-agent regimens in achieving therapeutic targets.

Discussion

This hospital-based study offers comprehensive insights into the prescribing trends of antihypertensive medications and their impact on blood pressure control among patients attending a tertiary care outpatient department. The demographic distribution revealed that hypertension was most common in individuals aged 41–60 years, which is consistent with the pathophysiological shift in vascular dynamics and lifestyle transitions observed during midlife. The slight male predominance observed may reflect differential exposure to risk factors such as occupational stress, smoking, and alcohol consumption, as well as greater health service utilization by males in this region [9].

Monotherapy remained the most commonly prescribed regimen in this study, particularly in patients with recently diagnosed stage I hypertension or without significant comorbidities. This aligns with global guidelines such as the JNC 8 and Indian Hypertension Guidelines, which advocate initiating treatment with a single agent and escalating as needed. However, the use of combination therapy in over 40% of patients reflects a recognition of its necessity in patients with poorly controlled BP, long-standing disease, or multiple cardiovascular risk factors [10]. Among the

prescribed agents, calcium channel blockers emerged as the most commonly used class, followed closely by angiotensin receptor blockers. This finding is consistent with prior Indian studies that have emphasized the popularity of amlodipine and telmisartan due to their efficacy, safety profile, and once-daily dosing, making them suitable for diverse patient groups including the elderly [11].

The moderate utilization of beta blockers and diuretics is notable. While these remain essential options, particularly in patients with ischemic heart disease or fluid retention, they are often reserved as adjunctive agents or for specific indications. The observed preference for ARBs over ACE inhibitors suggests a shift in clinical practice due to the superior tolerability of ARBs, especially regarding the reduced incidence of dry cough and angioedema [12].

Combination therapies most frequently involved ARBs and CCBs, which target different physiological mechanisms and provide synergistic blood pressure control. The relatively modest use of fixed-dose combinations—despite their recognized benefits in improving adherence and reducing pill burden—indicates an area for potential improvement. Greater adoption of FDCs could particularly benefit elderly patients or those on polypharmacy [13,14].

All antihypertensive drugs were prescribed in oral formulations, with a strong preference for once-daily dosing. This strategy is consistent with efforts to enhance compliance, especially in an outpatient setting where long-term adherence is crucial. Generic drug prescribing was observed in over 60% of prescriptions, which is a positive trend toward affordability and rational drug use. However, the continued presence of branded prescriptions indicates that prescriber preferences, pharmaceutical marketing, and patient perception still influence decision-making [15,16].

Adjunctive medications such as statins and antiplatelets were frequently co-prescribed, highlighting a patient population at elevated cardiovascular risk, often requiring multi-modal risk reduction strategies. This trend also reflects physician awareness of the broader implications of hypertension management beyond mere BP control [17].

The clinical outcomes of the study were significant: there was a clear and statistically meaningful reduction in both systolic and diastolic blood pressure following treatment. The magnitude of BP reduction was greater among patients on combination therapy compared to monotherapy, reaffirming the clinical efficacy of dual-agent regimens in achieving therapeutic goals, particularly in cases where monotherapy alone is insufficient. These findings are in line with previous literature which supports the use of combination therapy for faster and more sustained BP control [18].

Despite these strengths, the study has several limitations. Being cross-sectional in design, it captures only a snapshot of prescribing behavior and outcomes. Patient adherence was not evaluated, which is a major determinant of long-term BP control [19]. The lack of follow-up on cardiovascular morbidity or mortality limits the study's applicability in predicting long-term benefits. Furthermore, the single-center setting may reduce generalizability to other populations or healthcare settings [20].

Nonetheless, the study offers valuable data on real-world prescription patterns and highlights opportunities to enhance rational prescribing. The moderate uptake of fixed-dose combinations, the mix of branded and generic prescribing, and the reliance on specific drug classes reflect a complex interplay of clinical judgment, patient characteristics, and institutional practices. Continued periodic audits and feedback-based interventions can help ensure alignment with evolving national and international guidelines and improve patient outcomes.

Conclusion

This hospital-based study provides critical insights into antihypertensive drug prescription patterns and their influence on blood pressure outcomes in a tertiary care outpatient setting. The results reflect an overall rational prescribing approach, with appropriate use of monotherapy in early-stage hypertensives and judicious application of combination therapy in patients requiring intensified control. Calcium channel blockers and angiotensin receptor blockers were the most commonly prescribed drug classes, in alignment with current guidelines, while fixed-dose combinations were utilized in a substantial proportion of cases to enhance compliance. Generic drug usage was observed in a majority of prescriptions, reflecting an encouraging trend toward cost-effective prescribing, though scope remains for further improvement. The inclusion of adjunctive medications such as statins and antiplatelets highlights a comprehensive approach to cardiovascular risk management. Importantly, a statistically significant reduction in both systolic and diastolic blood pressure was observed following treatment, with better control rates among those on combination therapy. These findings underscore the effectiveness of individualized pharmacologic therapy tailored to patient needs and comorbidity profiles. The study also identifies areas for practice refinement, particularly regarding broader adoption of guideline-recommended fixed-dose combinations and consistent generic prescribing. While limited by

its cross-sectional nature and absence of adherence assessment, the study contributes meaningfully to the understanding of real-world antihypertensive drug use and sets the stage for targeted interventions to optimize hypertension care.

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