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Pharmacist-Guided Optimization of Blood Pressure–Lowering Therapy in Patients with Associated Comorbidities

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Abstract

Background: Hypertension commonly occurs with multiple comorbidities, increasing the complexity of treatment and the risk of drug interactions, medication errors, and poor therapeutic outcomes. Clinical pharmacists may improve treatment safety through prescription review, patient counselling, and medication-related interventions.

Methods: A prospective observational study was conducted among 450 hospitalized hypertensive patients in the Department of General Medicine at a tertiary care hospital from June 2023 to April 2025. Patient demographics, comorbidities, antihypertensive prescriptions, blood-pressure measurements, drug–drug interactions, medication errors, adverse drug reactions, and pharmacist interventions were evaluated. Prescription rationality was assessed using JNC 7 and Indian hypertension guidelines. Data were analysed using GraphPad Prism Version 5.

Results: Of the 450 patients, 265 (58.88%) were male and 185 (41.11%) were female, with the largest proportion aged ≥70 years (27.33%). Monotherapy was prescribed to 193 patients (42.88%), while 257 patients (57.11%) received combination therapy. Diuretics were the most frequently prescribed drug class (29.21%), followed by β-blockers (20.15%) and calcium channel blockers (20.00%). Amlodipine was the most commonly used monotherapy, whereas amlodipine plus atenolol was the most frequently prescribed two-drug combination. Most prescriptions (94.88%) were considered rational. Drug–drug interactions were frequently identified, highlighting the risks associated with polypharmacy and comorbidities. Clinical pharmacy services included counselling for 300 patients, identification of 24 medication errors, and monitoring of two adverse drug reactions. Several monotherapy and combination regimens produced clinically meaningful reductions in systolic and diastolic blood pressure.

Conclusion: Antihypertensive prescribing was largely rational, and combination therapy was frequently required to achieve adequate blood-pressure control. Clinical pharmacist participation contributed to the identification of medication-related problems, patient education, and safer antihypertensive treatment. Integrating clinical pharmacy services into routine hypertension management may improve medication safety and therapeutic outcomes.

Keywords: Hypertension, antihypertensive therapy, clinical pharmacist, comorbidities, drug–drug interactions, medication safety, rational prescribing.

INTRODUCTION

Hypertension is a chronic cardiovascular condition characterized by persistently elevated arterial blood pressure. It develops as a consequence of complex interactions involving vascular resistance, cardiac output, renal function, neurohormonal mechanisms, genetic predisposition, and lifestyle-related factors. Clinically, hypertension is commonly recognized by sustained elevation of systolic and/or diastolic blood pressure and represents one of the major modifiable risk factors for cardiovascular and renal morbidity.

Persistent elevation of blood pressure can progressively damage the vascular system and several target organs. If inadequately controlled, hypertension may contribute to the development of congestive heart failure, coronary and ischemic heart disease, chronic kidney dysfunction, cerebrovascular accidents, peripheral vascular disease, and other serious complications. Appropriate diagnosis, early initiation of therapy, regular monitoring, and sustained adherence to treatment are therefore essential for reducing hypertension-associated complications.

Management of hypertension includes both pharmacological and non-pharmacological approaches. Antihypertensive therapy may involve several classes of medications, including diuretics, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, calcium channel blockers, beta-adrenergic blockers, and other agents selected according to the patient's clinical condition. The choice of therapy may be influenced by blood pressure severity, age, comorbid conditions, target-organ damage, previous treatment response, and the presence of specific clinical indications.

Because patients with hypertension frequently have multiple associated diseases and may receive several medications simultaneously, there is an increased possibility of drug–drug interactions, adverse drug reactions, inappropriate dosing, medication errors, and poor adherence. These medication-related problems can negatively influence the effectiveness and safety of antihypertensive therapy.

Clinical pharmacists can play an important role in the multidisciplinary management of hypertension by reviewing prescriptions, identifying potentially inappropriate therapy, detecting clinically relevant drug interactions, monitoring adverse drug reactions, evaluating medication adherence, and recommending suitable therapeutic modifications. They can also provide individualized counselling regarding medication use, dietary practices, salt restriction, physical activity, smoking cessation, alcohol moderation, and regular blood pressure monitoring.

The present study was undertaken to examine antihypertensive medication utilization among hospitalized patients and to assess the contribution of clinical pharmacy services toward improving the quality and safety of hypertension management.

Objectives of the Study

The study was conducted with the following objectives:

1. To examine the appropriateness and rationality of antihypertensive medication use among hospitalized patients with hypertension.
2. To identify and evaluate medication-related problems, including drug–drug interactions, adverse drug reactions, and medication errors.
3. To implement pharmacist-led interventions aimed at improving the safety and effectiveness of antihypertensive therapy.
4. To obtain comprehensive medication histories and provide individualized patient counselling.
5. To evaluate the therapeutic effectiveness of commonly prescribed antihypertensive medications.
6. To compare the clinical response associated with antihypertensive monotherapy and combination therapy.
7. To promote medication adherence and appropriate lifestyle modification among patients with hypertension.
8. To assess the overall contribution of clinical pharmacy services to improved therapeutic outcomes and medication safety.

MATERIAL AND METHODOLOGY

Study Site

The present study was conducted in the Department of General Medicine at a tertiary care hospital.

Study Design

This was a prospective observational study.

Study Period

The study was carried out over a period of two years, from June 2023 to April 2025.

Study Criteria

Inclusion Criteria

1. Inpatients of either gender aged ≥ 18 years who were diagnosed with primary or secondary hypertension.
2. Patients who were receiving antihypertensive medications.

Exclusion Criteria

1. Patients attending the outpatient department (OPD).
2. Pregnant women.
3. Children below 18 years of age.

Source of Data

Data for this study were obtained through:

1. Direct patient interviews (for demographic details, past medical and medication history).
2. Review of patient case notes, treatment charts, laboratory reports, and discharge summaries.

Study Method

This prospective, longitudinal study was conducted to assess the prescribing patterns of antihypertensive drugs among inpatients diagnosed with hypertension in the general medicine department.

1. Data were collected by reviewing and recording patient case sheets.
2. Signs and symptoms (both common and uncommon) observed in patients were documented.
3. Past medical and family history, as well as social habits (such as smoking and alcohol consumption), were noted in a patient profile form.
4. Therapeutic data including drug name, dose, frequency, and duration of therapy were collected from patient treatment charts.
5. Drug–drug interactions were assessed using the Micromedex 2.0 database and recorded in a drug interaction form.
6. Any clinical interventions made during the study were documented using intervention reporting forms.
7. Follow-up was carried out for all patients until hospital discharge.

The collected data were analyzed as per the JNC 7 and IGH-II guidelines. Inpatient data were entered, stored, and managed in Microsoft Office Access for retrieval and analysis.

Statistical Analysis

Data analysis was performed using GraphPad Prism Version 5.

1. Continuous data were expressed as mean ± SEM (Standard Error of Mean).
2. Categorical data were presented as percentages.
3. Unpaired Student’s t-test was used to compare differences between means of two groups.
4. A p-value < 0.05 was considered statistically significant.

RESULTS

Age and Gender Distribution of Hypertensive Patients

A total of 450 hypertensive inpatients were included in the study. Of these, 265 (58.88%) were male and 185 (41.11%) were female.

The majority of patients belonged to the ≥70 years age group (123, 27.33%), followed by:

1. 60–69 years: 119 (26.44%)
2. 50–59 years: 102 (22.66%)
3. 40–49 years: 80 (17.77%)
4. 30–39 years: 24 (5.33%)
5. 20–29 years: 2 (0.44%)

(Figures 1 & 2 illustrate the age and gender distribution.)

Co-morbidities in Hypertensive Patients

Among the study population, the distribution of co-morbidities was as follows:

1. One co-morbidity: 213 patients (53.77%)
2. Two co-morbidities: 155 patients (34.44%)
3. Three co-morbidities: 60 patients (13.33%)
4. More than four co-morbidities: 29 patients (6.44%)
5. Mortality: 3 patients (0.66%)

The average number of co-morbidities per patient was also calculated (Fig. 3).

Classes of Antihypertensive Drugs Prescribed

Eight different classes of antihypertensive drugs were prescribed:

Drug Class	Number of Prescriptions	Percentage
Diuretics	187	29.21%
β-blockers	129	20.15%
Calcium channel blockers (CCBs)	128	20.00%
Angiotensin receptor blockers (ARBs)	97	15.15%
ACE inhibitors	67	10.46%
α-blockers	12	1.87%
Centrally acting drugs	13	2.88%
α+β blockers	10	1.56%

(Fig. 4)

Pattern of Antihypertensive Drug Regimens

Among 450 patients, the distribution of drug regimens was:

1. Monotherapy: 193 patients (42.88%)
2. Two-drug combination: 173 patients (38.44%)
3. Three-drug combination: 68 patients (15.11%)
4. Four or more drugs: 16 patients (3.55%)

Monotherapy: The most commonly prescribed drugs were:

1. Amlodipine: 80 (17.77%)
2. Furosemide: 47 (10.44%)
3. Ramipril: 12 (2.66%)
4. Metoprolol: 10 (2.22%)

5. Nebivolol: 7 (1.55%)
6. Telmisartan, Propranolol, Atenolol: 5 each (1.11%)
7. Hydrochlorothiazide: 4 (0.88%)
8. Olmesartan, Enalapril: 2 each (0.44%)
9. Clinidipine, Carvedilol: 1 each (0.22%)

(Fig. 6)

Two-drug combinations: Most frequent combinations were:

1. Amlodipine + Atenolol: 65 (14.44%)
2. Amlodipine + Hydrochlorothiazide: 40 (8.88%)
3. Torsemide + Spironolactone: 10 (2.22%)
4. Furosemide + Spironolactone: 7 (1.55%)
5. Amlodipine + Furosemide, Furosemide + Losartan: 5 each (1.11%)
6. Losartan + Hydrochlorothiazide, Losartan + Ramipril: 4 each (0.88%)
7. Amlodipine + Losartan: 3 (0.66%)
8. Rare combinations (Ramipril + Torsemide, Furosemide + Telmisartan, Amlodipine + Metoprolol, Telmisartan + Amlodipine): 2 each (0.44%)

(Fig. 7)

Three-drug combinations:

1. Most common: Amlodipine + Atenolol + Furosemide: 20 (4.44%)
2. Less common: Amlodipine + Metoprolol + Hydrochlorothiazide: 2 (0.44%)

Four or more drug combinations:

1. Furosemide + Amlodipine + Losartan + Hydrochlorothiazide: 6 (1.33%)
2. Bisoprolol + Amlodipine + Torsemide + Spironolactone: 4 (0.88%)
3. Furosemide + Clonidine + Amlodipine + Atenolol: 3 (0.66%)
4. Amlodipine + Atenolol + Furosemide + Losartan + Hydrochlorothiazide: 2 (0.44%)
5. Amlodipine + Atenolol + Furosemide + Prazosin: 1 (0.22%)

(Fig. 8)

Assessment of Drug-Drug Interactions in Antihypertensive Prescriptions

During the study, a total of 395 drug–drug interactions (DDIs) were identified. Their severity was categorized as follows:

1. Major interactions: 137 (30.44%)
2. Moderate interactions: 255 (56.66%)
3. Minor interactions: 7 (1.55%)

Among the major DDIs, the most frequent were:

1. Aspirin + Clopidogrel: 85
2. Insulin + Moxifloxacin: 13
3. Amlodipine + Clopidogrel: 9

Among the moderate DDIs, the most common were:

1. Aspirin + Ramipril: 12
2. Diclofenac + Losartan: 6

(Figures 9 & 10)

Assessment of Rationality of Antihypertensive Prescriptions

The rationality of prescriptions was evaluated according to JNC 7 guidelines. Out of 450 patients, 427 (94.88%) were prescribed antihypertensive drugs rationally, while 23 (5.11%) received irrational prescriptions (Fig. 11).

Efficacy of Antihypertensive Agents

Different classes of antihypertensive drugs were evaluated for their effect on systolic (SBP) and diastolic blood pressure (DBP):

- Monotherapy:
  - Amlodipine significantly reduced DBP (p = 0.216).
  - Furosemide significantly reduced SBP (p = 0.0034).
  - Overall, SBP showed a significant reduction on discharge compared to admission (p = 0.0034).
- Combination therapy:
  - Amlodipine + Metoprolol: significant reduction in SBP (p = 0.034) and DBP (p = 0.144) at discharge.
  - Amlodipine + Ramipril: reduction in SBP was observed (p = 0.6253), though not statistically significant.

(Results detailed in Tables 1, 2 & 3)

Comparison of Efficacy Between Monotherapy and Combination Therapy

The study compared the efficacy of selected antihypertensive drugs in mono versus combination regimens:

- Amlodipine + Atenolol: mean SBP reduction was significantly greater than Amlodipine monotherapy (p = 0.018).
- Furosemide + Losartan: mean SBP and DBP reduction were greater than Furosemide alone, with significant increase in DBP (p = 0.451).
- Other combinations did not show statistically significant differences.
- (Results detailed in Tables 4, 5, 6 & 7)

Clinical Pharmacy Services in Hypertensive Patients

Clinical pharmacy services provided during hospitalization included:

- Patient counseling: 300 patients (66.66%)
- Drug–drug interaction interventions (major + moderate): 387 cases (27.77%)
- Adverse drug reactions (ADRs): 2 patients (0.44%)
- Medication errors: 24 cases (5.33%)

(Fig. 12)

These interventions demonstrate the role of clinical pharmacy in optimizing antihypertensive therapy and minimizing adverse outcomes

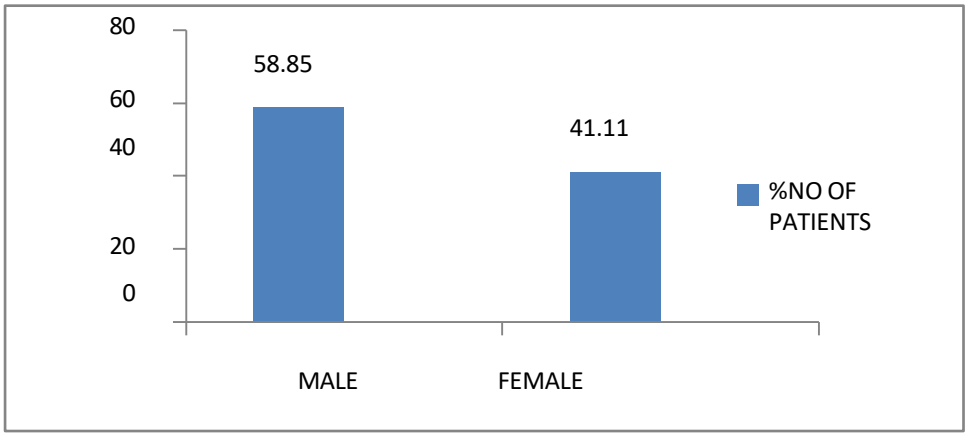

Fig 1: According to Gender Wise Distribution:

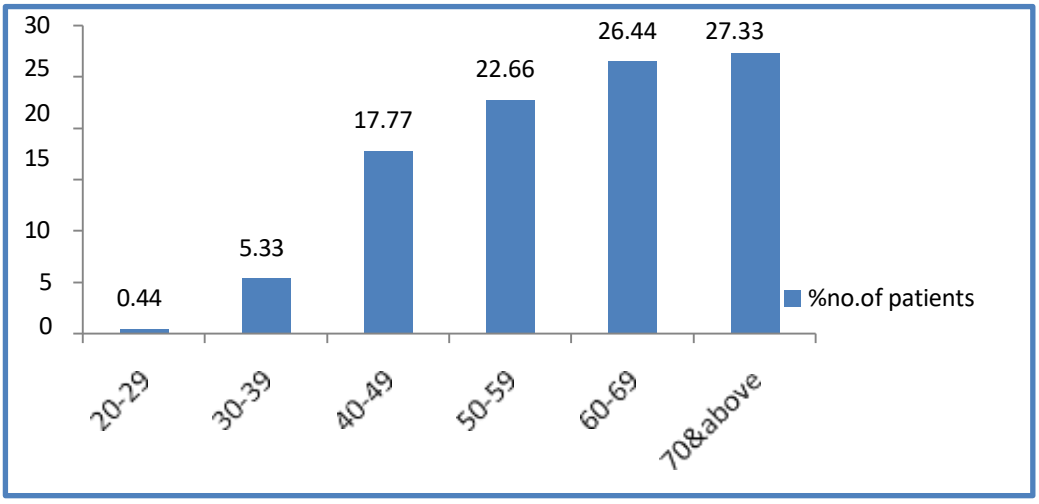

Fig 2: Age Wise Distribution

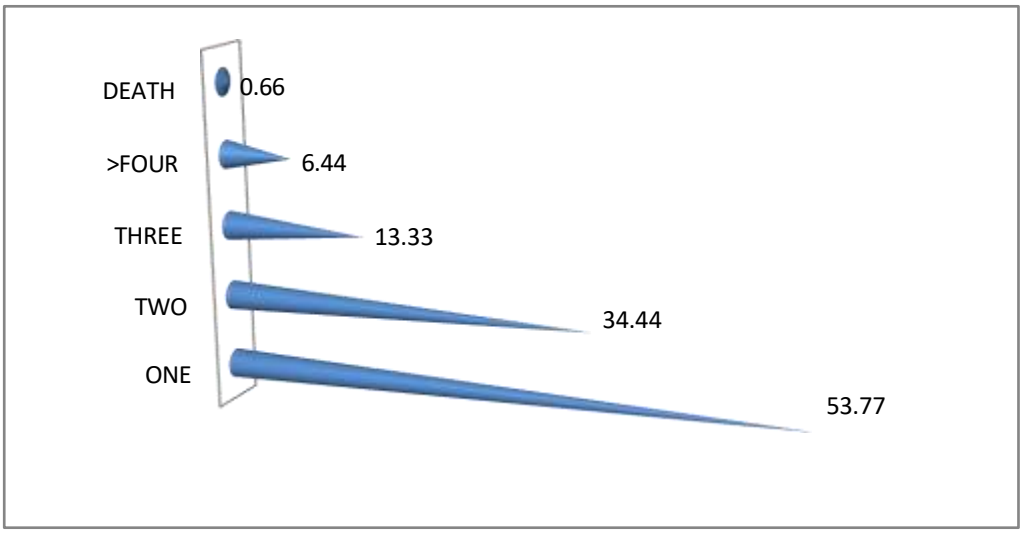

Fig 3: Percentage of Co-morbidities in Antihypertensive in-patients at tertiary care hospital

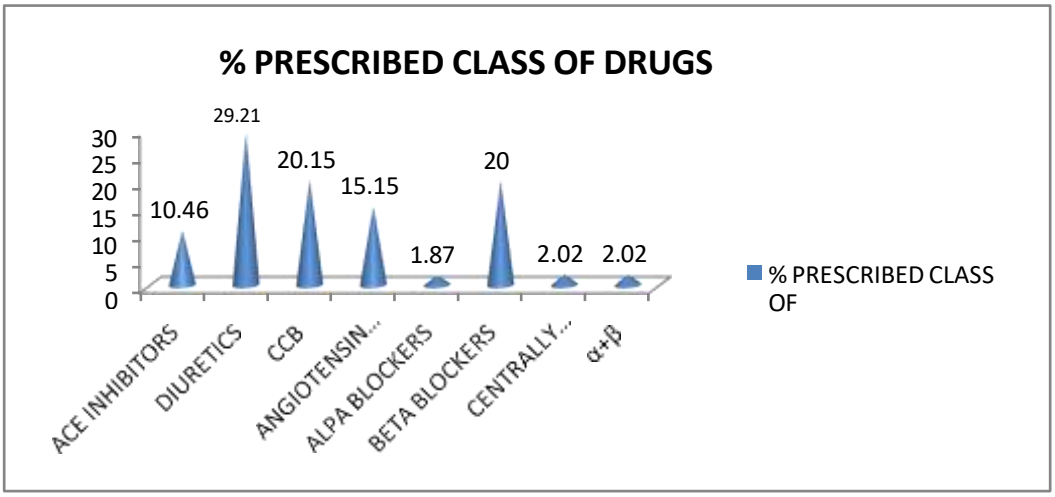

Fig 4: Percentage Classof Antihypertensive Drugs Prescribed for Hypertension Patients

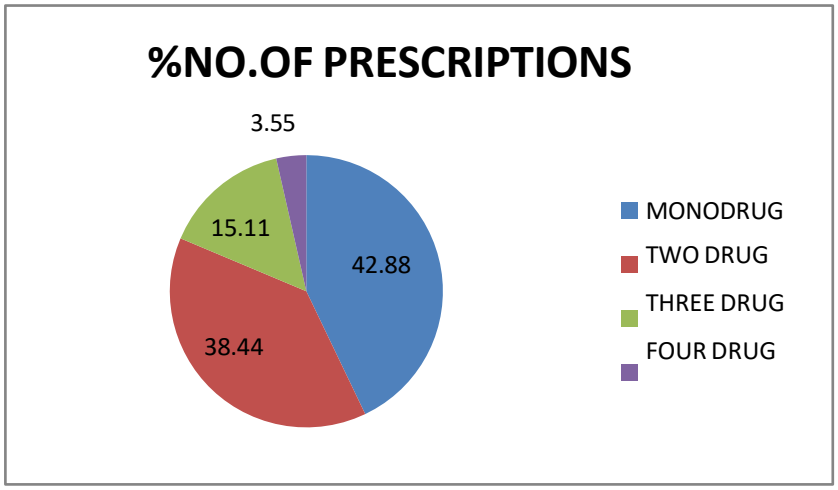

Fig 5: Percentage Pattern of drug regimen prescribed for hypertensive patients

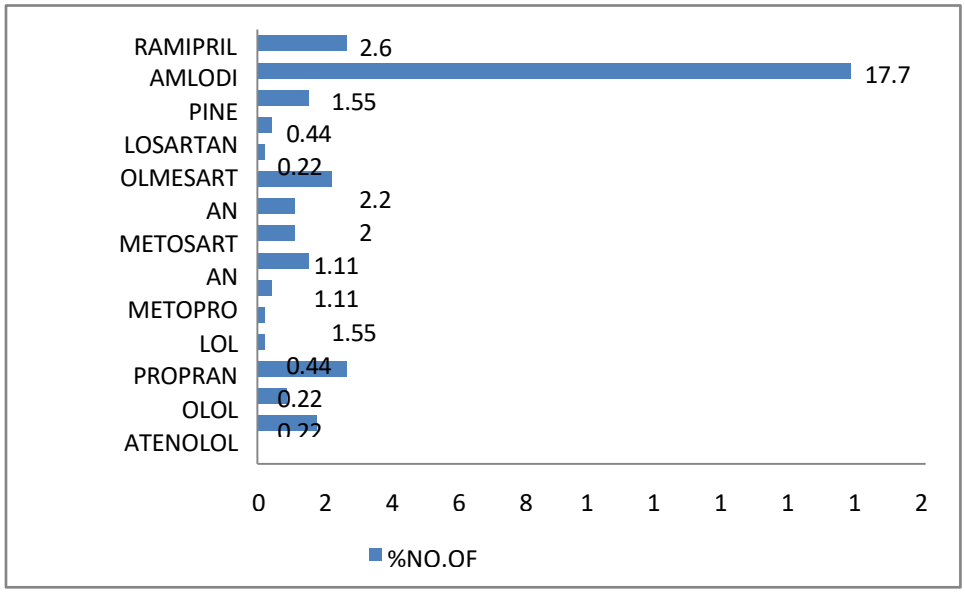

Fig 6: percentage of mono drug regimen prescribed for hypertensive patients

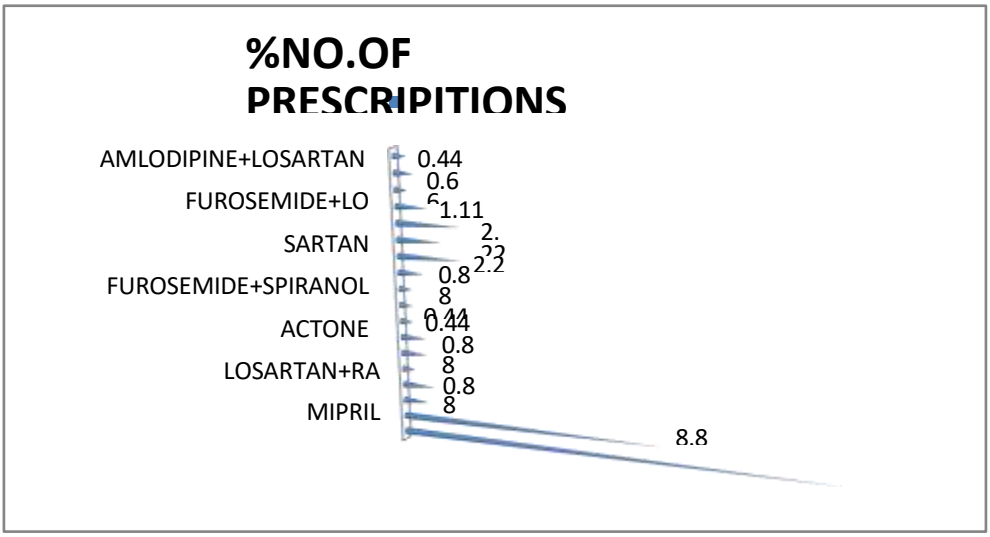

Fig 7: Two Drug Regimen Prescribed for Hypertensive Patients

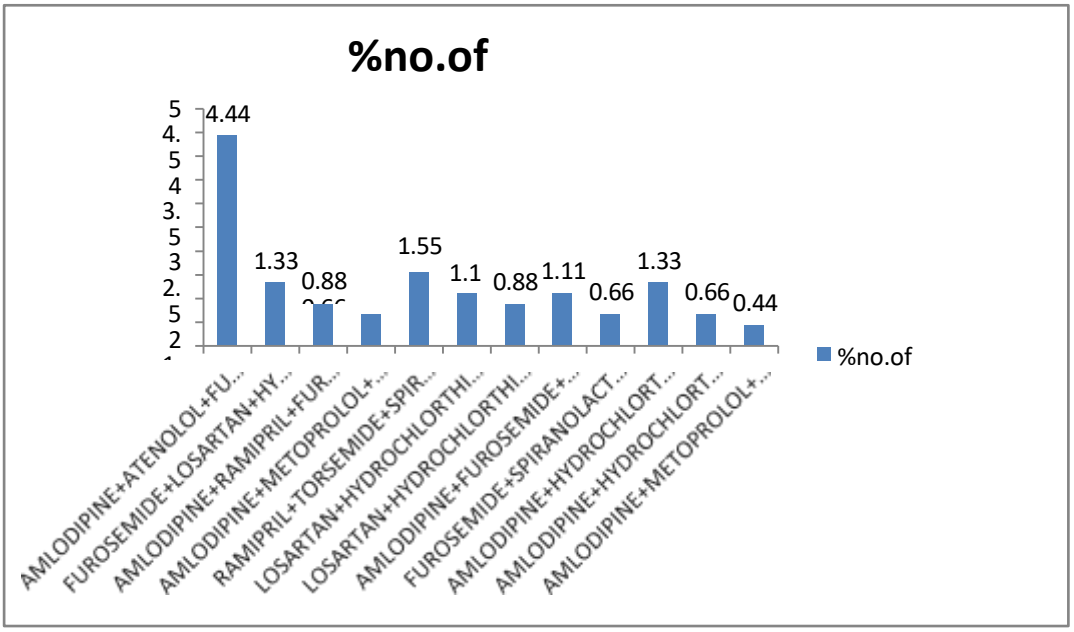

Fig 8: Three Drug Regimen Prescribed for Hypertensive Patients

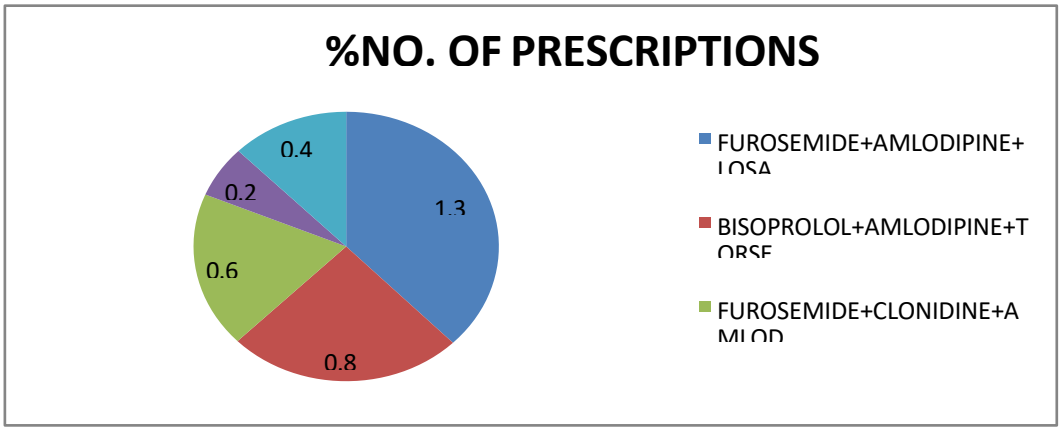

Fig 9: four Drug Regimen Prescribed for Hypertensive Patients

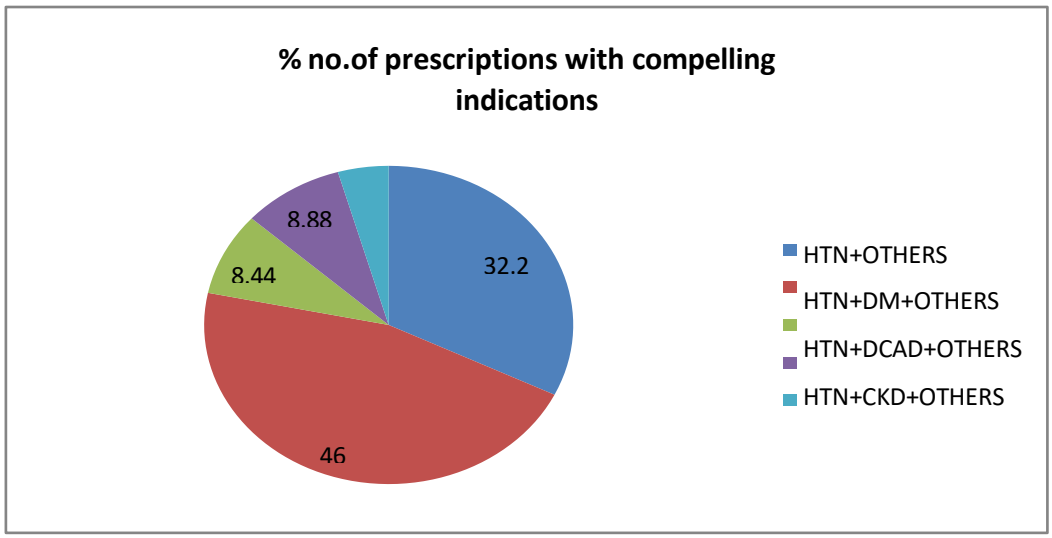

Fig 10: Number of prescriptions with compelling indications

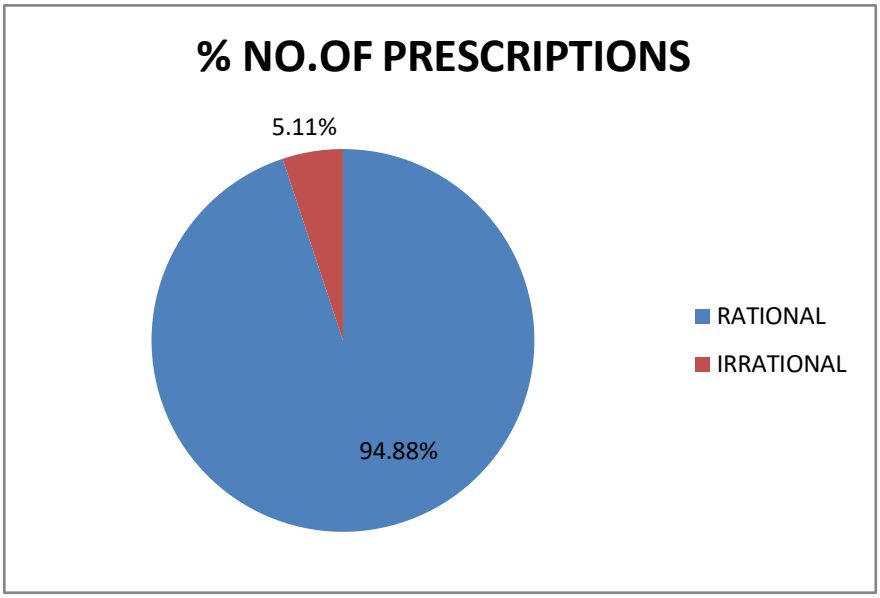

Fig 11: Rationality of antihypertensive drug prescribed for patients

Table 1: Efficacy of Monotherapy Antihypertensive Drugs in Patients in A Tertiary Care Hospital:

BLOOD PRESSURE MEAN±SEM	ON ADMISSION	ON DISCHARGE	P-VALUE	T-VALUE
ATENOLOL				
SBP	152±6.268	130±2.981	0.116	**2.561**
DBP	86.75±5.126	80.26±2.45	0.0138	**2.135**
METOPROLOL				
SBP	150±6.268	124±3.910	0.0034	2.520
DBP	83.45±5.425	80.12±1.231	0.44	2.152
LOSARTAN				
SBP	148±6.761	130.5±2.589	0.0286	2.506
DBP	82.75±5.126	76.25±1.830	0.2522	1.194
ENALAPRIL				
SBP	137.1 ± 13.22	128.4 ± 1.601	0.5253	0.6543
DBP	85.36±12.22	82.29±2.012	0.8561	0.4561
OLMESARTAN				
SBP	148.8±6.417	130.1±2.948	0.1156	2.756
DBP	84.29 ± 6.117	84.29 ± 6.117	0.9678	0.04120
NEBIVOLOL				
SBP	137.6±6.561	125.3±3.847	0.0236	2.404
DBP	80.71±3.225	77.57±2.517	0.4493	0.7682

Table 2: Efficacy of Monotherapy Antihypertensive Drugs in Patients in A Tertiary Care Hospital:

BLOOD PRESSURE MEAN±SEM	On Admission	On Discharge	p-VALUE	t-VALUE
AMLODIPINE				
SBP	155±6.268	132±2.881	0.216	2.861
DBP	85.75±5.126	80.26±2.45	0.238	2.235
FUROSEMIDE				
SBP	152±6.268	124±3.910	0.0034	2.520
DBP	86.45±5.425	80.12±1.231	0.44	2.152

TORSEMIDE				
SBP	146±5.761	132.5±2.589	0.286	2.606
DBP	85.75±5.126	78.25±1.830	0.1522	1.294
RAMIPRIL				
SBP	138.1 ± 13.22	125.4 ± 1.601	0.6253	0.7543
DBP	83.36±12.22	80.29±2.012	0.6561	0.3561
LOSARTAN				
SBP	145.8±5.417	132.1±2.948	0.2156	2.756
DBP	82.29 ± 5.117	85.29 ± 6.117	0.8678	0.0312
CLINIDIPINE				
SBP	135.6±6.561	128.3±3.847	0.1236	2.504
DBP	82.71±3.225	78.57±2.517	0.6493	0.8682

Table 3: Efficacy of two drug therapy Antihypertensive Drugs in Patients in A Tertiary Care Hospital:

BLOOD PRESSURE MEAN±SEM	ON ADMISSION	ON DISCHARGE	P-VALUE	T-VALUE
ATENOLOL±AMLODIPINE				
SBP	178±8.268	132±2.981	0.4516	2.891
DBP	92.75±8.126	80.26±2.45	0.4138	2.035
METOPROLOL±AMLODIPINE				
SBP	175±6.268	125±3.910	0.034	2.620
DBP	88.45±5.425	82.12±1.231	0.144	2.352
LOSARTAN±HYDROCHLORTHIAZIDE				
SBP	176.2±6.761	130.5±2.589	0.0286	2.506
DBP	89.75±5.126	76.25±1.830	0.2522	1.194
RAMIPRIL±AMLODIPINE				
SBP	167.1 ± 13.22	128.4 ± 1.601	0.6253	0.6843
DBP	85.36±12.22	82.29±2.012	0.8561	0.4561
FUROSEMIDE±RAMIPRIL				
SBP	168.8±6.417	130.1±2.948	0.1156	2.756
DBP	89.29 ±6.117	84.29 ± 6.117	0.8678	0.04120
AMLODIPINE±FUROSEMIDE				
SBP	177.6±6.561	125.3±3.847	0.1236	2.5104
DBP	87.71±3.225	78.57±2.517	0.5493	0.1682

Table 4: Comparison of efficacy between mono and combination therapy of amlodipine:

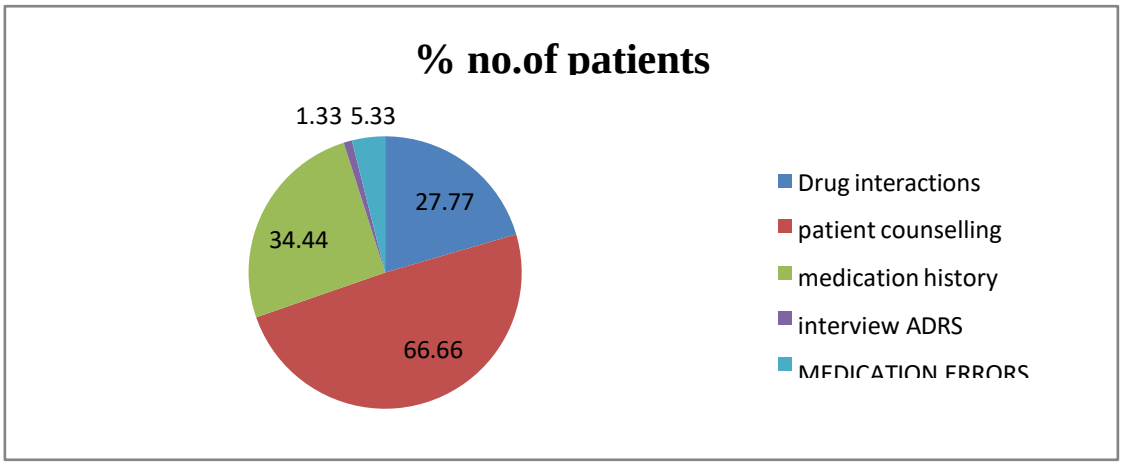

Fig 12: Clinical Pharmacy Services Provided in Antihypertensive Patients.

DISCUSSION

Prescription-based drug utilization studies are valuable tools for assessing the prescribing practices of physicians, evaluating medication-use patterns, and identifying opportunities to promote rational pharmacotherapy. With rapid socioeconomic development and lifestyle transition, India is experiencing an increasing burden of non-communicable diseases, particularly coronary artery disease, obesity, diabetes mellitus, and hypertension. Hypertension has emerged as one of the most important cardiovascular risk factors and represents a major public-health concern in both urban and rural populations.

Age is an important determinant of hypertension because advancing age is associated with cumulative exposure to environmental risk factors, vascular changes, and physiological stress. Previous studies have reported a higher prevalence of hypertension among older adults, particularly males aged 50–59 years and females aged 60–64 years in urban populations, while both sexes in rural populations commonly demonstrate increased prevalence in the 60–64-year age group. The findings of the present study were consistent with these observations, as the majority of hypertensive patients belonged to the 50–70-year age group, further supporting increasing age as an important risk factor for hypertension.

Clinical pharmacist involvement represents an important component of comprehensive hypertension management. Pharmacist-led interventions have been shown to improve patients' knowledge regarding hypertension, enhance adherence to prescribed therapy, promote appropriate lifestyle modification, and contribute to better blood pressure control. In the present study, clinical pharmacy services were incorporated through medication review, identification of drug-related problems, assessment of potential drug–drug interactions, patient counselling, and reinforcement of medication adherence. Such interventions can support safer and more effective antihypertensive therapy.

Among the antihypertensive medications prescribed in the present study, diuretics were the most frequently used drug class, followed by calcium channel blockers and β-blockers. This prescribing pattern was broadly consistent with reports from other regions and reflected the treatment principles described in the guidelines used for evaluation in the study. The frequent use of diuretics may be attributed to their established antihypertensive efficacy, clinical familiarity, affordability, and usefulness either as monotherapy or as part of combination therapy.

The analysis of treatment regimens demonstrated that 57.11% of patients received combination antihypertensive therapy, whereas 42.88% received monotherapy. Combination therapy is often required in patients who do not achieve adequate blood pressure control with a single antihypertensive agent, particularly in those with markedly elevated blood pressure or associated co-morbidities. Nevertheless, the proportion of patients receiving combination therapy in the present study was lower than that reported in certain previous studies. This variation may be influenced by differences in patient characteristics, disease severity, co-morbid conditions, institutional prescribing practices, economic considerations, and the potential risk of drug–drug interactions.

The rationality of antihypertensive prescribing was assessed with reference to the JNC VII and Indian hypertension guidelines. Of the 450 patients evaluated, 427 patients (94.88%) received prescriptions considered rational, whereas 23 patients (5.11%) received prescriptions classified as irrational. The high proportion of rational prescribing suggests that physicians in the study setting largely followed established therapeutic recommendations while selecting antihypertensive medications.

Evaluation of therapeutic effectiveness demonstrated that several antihypertensive regimens were associated with clinically meaningful reductions in both systolic blood pressure (SBP) and diastolic blood pressure (DBP). Combination therapy generally produced greater reductions in blood pressure than monotherapy in appropriately selected patients. These findings support the use of combination treatment when a single agent is insufficient to achieve the desired blood pressure target. However, not all individual combinations produced statistically significant reductions, indicating that therapeutic response varies between patients and emphasizing the importance of individualized treatment selection and regular monitoring.

A considerable number of drug–drug interactions (DDIs) were identified during the study. A total of 387 DDIs were detected among 450 patients, indicating the substantial potential for medication-related problems in hospitalized hypertensive patients, many of whom receive multiple medications for associated co-morbid conditions. Polypharmacy increases the probability of clinically relevant interactions and highlights the importance of systematic prescription review. Clinical pharmacists can contribute significantly by identifying potential interactions, communicating clinically relevant findings to physicians, recommending appropriate modifications, and monitoring patients for adverse consequences.

The findings of the present study indicate that the prescribing pattern of antihypertensive medications in the hospital was largely consistent with the JNC VII and IGH guidelines, with diuretics, calcium channel blockers, and β-blockers representing the most commonly utilized therapeutic classes. Nevertheless, appropriate drug selection alone may not ensure optimal blood pressure control. Patient-related factors such as medication adherence, dietary habits, physical activity, smoking, alcohol consumption, and understanding of the disease can substantially influence therapeutic outcomes.

Therefore, greater emphasis should be placed on patient education and counselling, including the importance of regular medication use, reduced dietary salt intake, weight management, physical activity, avoidance of tobacco use, moderation of alcohol intake, routine blood pressure monitoring, and regular medical follow-up. Such measures may enhance the effectiveness of pharmacological therapy and reduce the long-term risk of cardiovascular and renal complications.

Overall, the study highlights the important contribution of clinical pharmacy services in the management of hypertension. Patient counselling, medication-history assessment, monitoring for drug interactions, identification of medication-related problems, and promotion of adherence may improve medication safety and support better therapeutic outcomes. The effectiveness of both monotherapy and combination antihypertensive regimens was assessed by changes in blood pressure, with results expressed as mean ± SEM and statistical significance interpreted as $p<0.05$, $*p<0.01$, and $**p<0.001$ using the unpaired Student's *t*-test.

CONCLUSION

The present study demonstrates that antihypertensive medications were generally prescribed in a rational manner among hospitalized patients with hypertension, with the majority of prescriptions complying with the therapeutic guidelines used for evaluation. Diuretics, calcium channel blockers, and β-blockers were among the most commonly prescribed antihypertensive drug classes, while both monotherapy and combination therapy were employed according to individual patient requirements.

Combination therapy was frequently used and was associated with effective blood pressure reduction in several patients, particularly where monotherapy was insufficient to achieve adequate control. However, the occurrence of drug–drug interactions and other medication-related problems emphasizes the need for careful selection, monitoring, and periodic review of antihypertensive treatment.

The study further highlights the important role of clinical pharmacists in improving the quality and safety of hypertension management. Clinical pharmacy services, including medication-history assessment, prescription review, identification of drug–drug interactions, monitoring of adverse drug reactions and medication errors, patient counselling, and reinforcement of medication adherence, can contribute substantially to improved therapeutic outcomes.

Based on the findings of the study, future efforts should focus on strengthening clinical pharmacy services within tertiary care hospitals, improving monitoring of medication-related problems, and promoting evidence-based antihypertensive prescribing. Similar drug-utilization studies may also be extended to other hospital departments to evaluate prescribing trends and identify opportunities for further improvement in rational medicine use.

Training programmes for hospital pharmacists and other healthcare professionals should be encouraged to strengthen medication review and clinical monitoring practices. Educational initiatives for prescribers should also emphasize the rational and individualized use of antihypertensive combinations. In addition, medication adherence assessment and lifestyle-modification counselling should be incorporated routinely into the management of all hospitalized patients with hypertension.

In conclusion, appropriate antihypertensive pharmacotherapy combined with regular monitoring, individualized treatment, medication adherence, lifestyle modification, and active clinical pharmacist involvement can contribute to safer medication use, improved blood pressure control, and better overall clinical outcomes in patients with hypertension.

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